Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks) (Big Cypress Creek Bacteria Assessment) TSSWCB Project #09-54

Quality Assurance Project Plan

Revision No. 2

Prepared by
Water Monitoring Solutions, Inc.
Sulphur Springs, Texas

For
Northeast Texas Municipal Water District
Hughes Springs, Texas

Funding Source:
Texas State Soil and Water Conservation Board

Effective Period: June 2009 to May 2011

Questions concerning this quality assurance project plan should be directed to:

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A1 Approval Sheet

Quality Assurance Project Plan (QAPP) for TSSWCB Project #09-54, *Assessment of Contact Recreation Use Impairments and Watershed Planning for Big Cypress Creek and Tributaries (Hart and Tankersley Creeks)(Big Cypress Creek Bacteria Assessment).*

Texas State Soil and Water Conservation Board (TSSWCB)

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Name: Donna Long
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Signature:_____ Date: _____

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Name: Walt Sears, Jr.
Title: NETMWD General Manager

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Name: Lee Thomas
Title: Project Manager

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Water Monitoring Solutions, Inc (WMS)

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Name: Augustine De La Cruz
Title: WMS Quality Assurance Officer

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Name: Scott Mgebroff
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Name: Linard Arocha
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Signature: _____ Date: _____

Ana-Lab Corporation

Name: Bill Peery
Title: Ana- Lab Executive Vice President

Signature: _____ Date: _____

Name: Roy White
Title: Ana-Lab Quality Assurance Officer

Signature: _____ Date: _____

A2 Table of Contents

A3 Distribution List

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

Texas State Soil and Water Conservation Board (TSSWCB)
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Name: Roy White
Title: Ana-Lab Quality Assurance Officer

List of Acronyms

AWRL	Ambient Water Reporting Limit
BAEN	Texas Agri-Life Research – Department of Biological and Agricultural Engineering
BMP	Best Management Practice
CAR	Corrective Action Report
COC	Chain of Custody
CRP	Clean Rivers Program
CWA	Clean Water Act
DOC	Demonstration of Capability
DMP	Data Management Plan
DMRG	Data Management Reference Guide
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
LCS	Laboratory Control Sample (formerly Laboratory Control Standard)
LCSD	Laboratory Control Sample Duplicate (formerly Laboratory Control Standard Duplicate)
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantitation (formerly reporting limit)
NCR	Nonconformance Report
NELAC	National Environmental Lab Accreditation Conference
NETMWD	Northeast Texas Municipal Water District
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
PO	Project Officer
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Specialist
QMP	Quality Management Plan
RPD	Relative Percent Difference
SAML	Texas Agri-Life Extension Service – Department of Soil and Crop Sciences
SLOC	Station Location Form
SOP	Standard Operating Procedure
SSL	Texas A&M University Spatial Science Laboratory
SWCD 417	Upshur-Gregg Soil and Water Conservation District
SWCD 419	Sulphur-Cypress Soil and Water Conservation District
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load

TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
TWRI	Texas A&M Agri-Life – Texas Water Resource Institute
WMS	Water Monitoring Solutions, Inc.
WQI	Water Quality Inventory
WWTF	Waste Water Treatment Facility

A4 Project/Task Organization

Texas State Soil and Water Conservation Board (TSSWCB)

Mitch Conine
TSSWCB Project Manager
Maintains a thorough knowledge of work activities, commitments, deliverables, and time frames associated with project. Develops lines of communication and working relationships between NETMWD and TSSWCB. Tracks deliverables to ensure that tasks are completed as specified in the contract. Responsible for ensuring that the project deliverables are submitted on time and are of acceptable quality and quantity to achieve project objectives. Participates in the development, approval, implementation, and maintenance of the QAPP. Assists the TSSWCB QAO in technical review of the QAPP. Responsible for verifying that the QAPP is followed by the NETMWD. Notifies the TSSWCB QAO of particular circumstances that may adversely affect the quality of data derived from the collection and analysis of samples. Enforces corrective action.

Donna Long
TSSWCB Quality Assurance Officer
Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Responsible for verifying that the QAPP is followed by project participants. Determines that the project meets the requirements for planning, quality assurance (QA), quality control (QC), and reporting under the CWA §319(h) NPS Grant Program. Monitors implementation of corrective actions. Coordinates or conducts audits of field and laboratory systems and procedures.

Northeast Texas Municipal Water District (NETMWD)

Walt Sears, Jr.
General Manager, Project Manager
Provides coordination and cooperation between the project partners, stakeholders, and WMS.

Lee Thomas
Project Manager
Responsible for implementing and monitoring TSSWCB requirements in contracts, QAPPs, and QAPP amendments and appendices. Coordinates basin planning activities and work of project partners. Conducts monitoring systems audits to ensure QAPPs are followed by basin planning agency participants. TSSWCB project managers and/or QAO are notified of deficiencies, and that any corrective actions or other outstanding issues are resolved. Responsible for validating that data collected are acceptable for reporting to the TSSWCB. Responsible for updating NETWMD website (www.netmwd.com) with current project information.

Water Monitoring Solutions, Inc. (WMS)

Randy Rushin
WMS Project Manager
Responsible for contact and coordination with NETMWD, TSSWCB and other entities participating in the Big Cypress Creek Bacteria Assessment activities. Responsible for reviewing the QAPP and monitoring its implementation. Responsible for implementing and monitoring the requirements in contracts, QAPP's and QAPP amendments and appendices and maintaining records of sub-tier commitment to requirements specified in this QAPP. Responsible for the supervision of all field activities which includes equipment preparation, sampling, sample preservation, fieldwork, sample transport, and chain-of-custody maintenance in compliance with the approved QAPP.

Designates subordinate responsibilities to WMS staff. Oversight of task progress and deliverables. Responsible for Conference Calls, meetings, workshops, initial and evolving QA/QC procedural assistance. Responsible for performing necessary data analysis and development of conclusions and recommendations in technical deliverables. Assists WMS QAO with 1) conducting monitoring systems audits; 2) ensuring that projects are producing data of known quality; 3) ensuring that subcontractors are qualified to perform contracted work; 4) notifying project managers and/or QA Specialists of deficiencies and non-conformances, and ensuring that issues are resolved; and 5) the validation of collected data are acceptable for reporting to the TSSWCB.

Augustine De La Cruz
WMS Quality Assurance Officer
Responsible for coordinating the implementing the QA program. Responsible for maintaining records of QAPP distribution, including appendices and amendments, as well as identification, and maintenance of project quality assurance records. Responsible for coordinating with the TSSWCB QAO to resolve QA-related issues and for notifying the WMS Project Manager of particular circumstances which may adversely affect the quality of data. Coordinates and monitors deficiencies and corrective actions. Coordinates and maintains records of data verification and validation. Conducts monitoring systems audits on the project participants to determine compliance with project and program specifications, issues written reports, and follows through on findings to verify and assure compliance specified in the QAPP. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Ensures that field staff is properly trained and that training records are maintained. Assists WMS Project Manager document task progress and track labor and non-labor expenditures and produce progress reports specified in the contract with NETWMD.

Scott Mgebroff
WMS Data Manager
Responsible for ensuring that field data are reviewed and verified. Coordinates with WMS QAO to provide current, readily available information for website use. Responsible for the basin Data Management Plan and assists WMS Project Manager and QAO in their duties as necessary.

Insures that all QA reviews are conducted in a timely manner. Responsible for the acquisition and verification of data to the TSSWCB and oversight of project data management. Responsible for ensuring data are submitted according to work-plan specifications, and provide the point of contact for the TSSWCB Data Manager to resolve issues related to the data.

Linard Arocha
WMS Technical Coordinator
Responsible for writing and maintaining the QAPP, QAPP distribution (including appendices and amendments), and assisting with conducting monitoring systems audits to verify and assure compliance specified in the QAPP.

Responsible for performing field sampling and data processing duties in accordance with standard operating procedures (SOP's), data quality objectives (DQO's) and this QAPP. Reports any deviation from SOP's or DQO's. Maintains proper documentation of sampling events, sample preservation, sample shipment, and field procedures at designated stations. Responsible for the supervision of all field activities, including water quality sampling and monitoring, and including equipment preparation, sample preservation, fieldwork, sample transport, and chain-of-custody maintenance in compliance with the approved QAPP. Oversees the work of the monitoring partners during sampling events.

Responsible for validation of all data collected to ensures the data quality objectives are met and suitable for reporting. Notifies WMS Project Manager of circumstances that may adversely affect data quality. Coordinates and monitors deficiencies, non-conformances and corrective actions. Coordinates and maintains records of data verification and validation. Assists with the data management phase of the monitoring systems audit. Reviews data from monitoring events and provides data quality comments to the QAO. Responsible for transfer of data to the TSSWCB in the acceptable format. Ensures that data are submitted to TSSWCB according to work-plan specifications.

Responsible for providing NETWMD with current data and information to update NETMWD website.

Ana-Lab Corporation

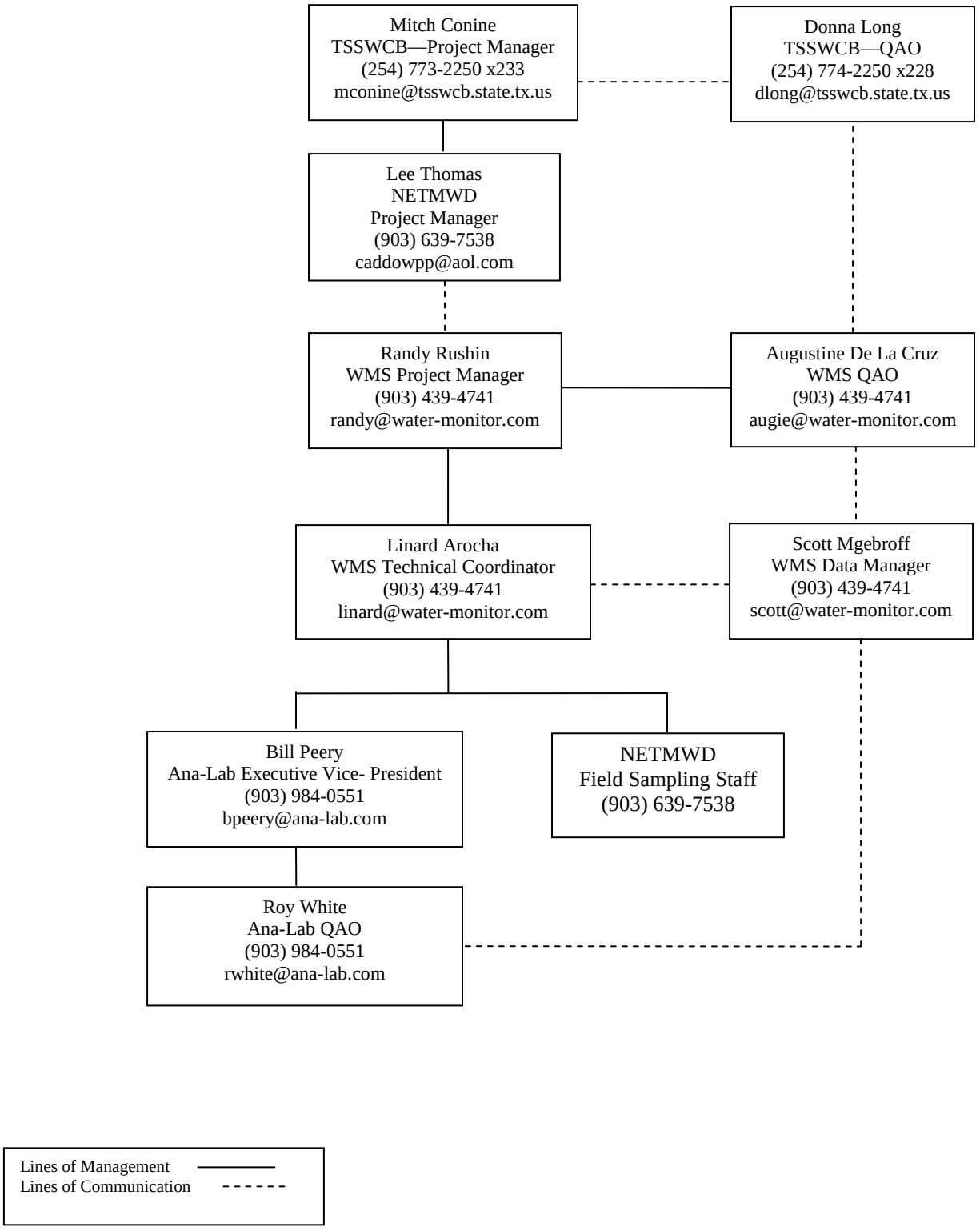
Bill Peery, Jr.,
Executive Vice President, Ana-Lab Corporation
Provides supervision for laboratory procedures and serves as the primary point of contact for all laboratory activity conducted by Ana-Lab Corporation. Responsible for oversight of all operations, ensuring that all QA/QC requirements are met, and documentation related to the analysis is completely and accurately reported.

Roy White
Quality Assurance Officer, Ana-Lab Corporation
Provides supervision for laboratory procedures. Provides laboratory quality assurance/quality control and responsible for updating the laboratory's QAPP. Responsible for ensuring that laboratory personnel involved in generating analytical data have adequate training and a thorough knowledge of the QAPP and all SOPs specific to the analysis or task performed and or supervised. Responsible for making sure QA/QC requirements of this QAPP are met for data generated by the NETMWD. Notifies the NETMWD Project Manager of circumstances that may adversely affect the quality of data. Enforces corrective actions as required and is responsible for supervision of laboratory personnel involved in generating analytical data for this project.

Responsible for traceability of laboratory standards and reagents, completeness and acceptability of chain of custody forms, maintaining current NELAC Accreditation, ensuring laboratory instrument and calibration data is complete. Ensures that laboratory analysis of QC samples occurs at the required frequency and assists WMS QAO with determination of QC results as they pertain to performance and program specifications. Responsible for the analytical sensitivity of laboratory instrumentation to levels consistent with this QAPP. Performs laboratory bench-level reviews and ensures that all laboratory samples are analyzed for all parameters.

Cypress Creek Basin Sampling Staff
The sampling staff composed of various NETMWD and WMS personnel. Their primary responsibility is to performance of all field activities, including sampling and monitoring in compliance with the approved QAPP. The sampling staff are responsible for reporting all sampling issues, missed sample collections, and non-conformances to the WMS Technical Coordinator.

Figure A4.1. Organization Chart - Lines of Communication



A5 Problem Definition/Background

Big Cypress Creek (and its tributaries) are located in the Cypress Creek Basin. The headwaters of Big Cypress Creek originate in southeast Hopkins County. From there, Big Cypress Creek flows east into Lake Cypress Springs and then into Lake Bob Sandlin in Franklin County. After leaving Lake Bob Sandlin, Big Cypress Creek, which forms the county line between Titus and Camp Counties, flows southeast to Lake O' the Pines and then finally to Caddo Lake before entering Louisiana. The watershed is characterized by gently rolling wooded hills and broad, frequently flooded, densely vegetated stream bottoms. Post oak savannah is predominant in the western portion of the basin, while pineywoods are common in the eastern portion.

The Big Cypress Creek watershed, between Lake Bob Sandlin and Lake O' the Pines, encompasses approximately 445 square miles in Camp, Morris, Titus and Upshur Counties. In 1996, Big Cypress Creek (Segment 0404) was placed on the Texas 303(d) List for having bacteria levels that exceed water quality standards. In 2000, Tankersley Creek (Segment 0404B) was placed on the 303(d) List for bacteria, and in 2006, Hart Creek (Segment 0404C) was placed on the 303(d) List for bacteria. Other tributaries to Big Cypress Creek are not currently impaired for bacteria, but they are likely contributing some degree of bacteria loading to the impaired reaches of Big Cypress Creek.

While the focus of this project will be on bacterial water quality issues in Segments 0404, 0404B, and 0404C, this watershed is covered by One Total Maximum Daily Load for Dissolved Oxygen in Lake O' the Pines (Segment 0403). The Segment 0404 watershed is the contributing watershed to Lake O' the Pines (Segment 0403) The TMDL was adopted by the TCEQ on April 12, 2006, approved by the TSSWCB on March 23, 2006 and approved by the EPA on June 7, 2006. The TMDL determined that low dissolved oxygen concentrations in the reservoir are due to high rates of photosynthesis and respiration in aquatic vegetation and that phosphorus is the limiting nutrient during the critical conditions. The TMDL determined that a 56% reduction in total phosphorus loading is needed to restore water quality. An Implementation Plan (I-Plan) was developed to reduce phosphorus loadings from the contributing watershed. Implementation strategies were identified for point source dischargers (total phosphorus effluent limits), animal feeding operations (BMPs to reduce runoff of sediment and nutrients from poultry litter application sites and dairies), forestry operations (BMPs to reduce runoff of sediment and nutrients), and other sources (on-site sewage facilities, boat sewage disposal, sites permitted for land application of domestic sewage sludge). On July 9, 2008, the TCEQ approved the Implementation Plan (I-Plan) for One TMDL for Dissolved Oxygen in Lake O' the Pines. The TSSWCB approved the I-Plan on July 17, 2008. It is anticipated that many of the implementation strategies designed to reduce phosphorus loadings will also have a positive impact on reducing bacteria loadings to Big Cypress Creek.

Through the Lake O' the Pines TMDL process, watershed stakeholders have become extremely familiar with water quality rules and regulations, as well as, approaches to watershed planning. As such, local stakeholders have already expressed interest in taking an active role in addressing the bacteria impairments.

Land use in the watershed is predominantly cropland and pasture (about 48%) and forest (about 40%). During periods of rainfall, which averages approximately 46 inches annually, bacteria originating from aquatic birds and mammals, livestock, inadequately treated sewage, and/or failing septic systems may be washed into the streams and have the potential to impede recreational use of the waterbodies. Bacterial indicators, such as E. coli, may remain in the streams at levels exceeding established criteria and can be measured well after a rain event has occurred. These microorganisms are normally found in wastes of warm-blooded animals and are generally not harmful to human health, but may indicate the presence of pathogens that can cause disease.

Lake O' the Pines and other waterbodies in its watershed are extremely important to the surrounding region. Lake O' the Pines provides drinking water for seven cities and towns, rural water districts, steel manufacturing and electric generating companies. In addition, the City of Longview (population 70,000) will be using the lake as a drinking water source in the near future. The lake is an important resource to the timber industry and to agricultural enterprises such as the poultry industry, dairies, cow/calf operations, and for irrigation. Recreation and tourism are significant sources of income for residents of the watershed. Boating and fishing for trophy bass, catfish, and crappie lure large numbers of recreational users to the watershed each year.

The TCEQ and the TSSWCB established a joint, technical Task Force on Bacteria TMDLs in September 2006 charged with making recommendations on cost-effective and time-efficient bacteria TMDL development methodologies. The Task Force recommended the use of a three-tier approach that is designed to be scientifically credible and accountable to watershed stakeholders. The tiers move through increasingly aggressive levels of data collection and analysis in order to achieve stakeholder consensus on needed load reductions and strategies to achieve those reductions. In June 2007, the TCEQ and the TSSWCB adopted the principles and general process recommended by the Task Force and directed agency staff to incorporate the principles of the recommendations into an updated joint-agency TMDL guidance document.

Major revisions to the Texas Surface Water Quality Standards are being drafted by TCEQ, including the establishment of numeric nutrient criteria for reservoirs and modifications to contact recreation use and bacteria criteria. As part of this process, TCEQ is developing procedures for conducting Recreational Use Attainability Analyses (RUAA). In order for a new category of recreational use or a different bacteria water quality standard to be applied to a waterbody, a RUAA will need to be conducted. TCEQ and TSSWCB have collaborated on developing a list of priority waterbodies for collecting information needed for RUAAs. Segments in this project's study area are on that list.

In accordance with the Memorandum of Agreement between the TCEQ and the TSSWCB Regarding TMDLs, Implementation Plans, and Watershed Protection Plans, the TSSWCB has agreed to take the lead role in addressing the bacteria impairments in the study area. Through this and associated projects, the TSSWCB and NETMWD will work with local stakeholders to progress through the data collection and analysis components of the first two tiers of the Task Force recommended three-tier approach.

The goal is to remove the waterbodies in the study area from the 303(d) List; however, the mechanism is not predetermined. At the end of this two-year assessment project, possible outcomes include:

1) waterbodies are achieving current water quality standards,
2) waterbodies are achieving revised water quality standards, based on TCEQ triennial review process,
3) adequate data exists to support a UAA to change water quality standards,
4) adequate data exists to develop a Watershed Protection Plan, or
5) adequate data exists to develop a TMDL and Implementation Plan for TCEQ adoption.

A6 Project/Task Description

NETMWD will facilitate public participation and coordinate stakeholder involvement to ensure that decision-making is founded on local input and that watershed planning activities are successful. NETMWD will provide logistical support for public meetings. At a minimum, public stakeholder meetings shall consist of an organizational/kick-off meeting, a source survey design meeting, a meeting presenting results from initial data analysis and the GIS inventory, a Texas Watershed Steward Program workshop, two project update meetings during the middle of the project, a meeting presenting data analysis results, and a meeting presenting final technical reports.

NETMWD will coordinate with Texas AgriLife Extension Service to host a Texas Watershed Steward Program workshop focused on the study area through TSSWCB project 07-09, Statewide Implementation of the Texas Watershed Steward Program. NETMWD will develop and disseminate educational materials to watershed stakeholders, including, but not limited to, flyers, brochures, letters, and news releases. NETMWD will include information about the project in the Clean Rivers Program Basin Summary Report and the Basin Highlights Report. NETMWD will contribute content matter to an internet webpage, to be hosted by TWRI, for the dissemination of project information.

NETMWD will develop a Quality Assurance Project Plan (QAPP) to ensure data of known and acceptable quality are generated and used in this project. The QAPP shall be consistent with the TSSWCB Environmental Data Quality Management Plan and various TCEQ guidelines for monitoring procedures and methods.

BAEN, through TSSWCB project 09-55 Modeling Support and Bacterial Source Tracking for Big Cypress Creek Bacteria Assessment, with assistance from NETMWD, will develop a comprehensive GIS inventory for the study area.

TSSWCB, in cooperation with SSL, will provide NETMWD a current land use classification, based on 2004-2006 imagery, for the study area through TSSWCB project 08-52, Classification of Current Land Use/Land Cover for Certain Watersheds Where TMDLs or WPPs Are In Development.

NETMWD will design and conduct a watershed source survey that better characterizes the possible sources of bacteria loadings. Local stakeholders and technical experts will be consulted in the development of the source survey, which will represent warm and cool seasons and low and high flow conditions. Locations of possible bacteria sources identified during the source survey will be incorporated into the GIS inventory.

To provide sufficient water quality data to characterize bacteria loadings across the various flow regimes, NETMWD will conduct routine ambient monitoring at 14 sites once every two weeks. Currently, routine ambient monitoring is conducted quarterly at 2 stations by TCEQ (10308 and 13631). NETMWD will conduct effluent monitoring at the outfalls of 2 wastewater treatment facilities (WWTFs) once every two weeks in an effort to estimate possible contributions from wastewater discharges. NETMWD will conduct biased-flow monitoring under high flow (storm

event influenced) conditions at the 14 stream sites and the 2 WWTFs during at least 8 storm events. NETMWD will establish, and maintain, continuous flow monitoring gages at 6 sites (1 per tributary). These sites will be located as close to the confluence with Big Cypress Creek as is feasible.

To determine bacteria load reductions needed to achieve water quality standards, BAEN in collaboration with NETMWD will conduct a Load Duration Curve (LDC) analysis of all historic and existing water quality monitoring data from the study area through TSSWCB project 09-55. Then, using water quality monitoring data collected through this project, NETMWD will assist BAEN in refining the developed LDCs. To estimate loadings from various sources and to identify critical loading areas within the watersheds, BAEN in collaboration with NETMWD will then conduct watershed modeling for the study area through TSSWCB project 09-55. Utilizing information from the GIS inventory, watershed source survey, and water quality monitoring, and in combination with the LDCs, BAEN through TSSWCB project 09-55 and in collaboration with NETMWD will develop a spatially explicit or mass balance model, such as SELECT, for the study area.

NETMWD will collaborate with SAML, through TSSWCB project 09-55, to conduct bacterial source tracking (BST) in the study area to assess and identify different sources contributing to bacteria loadings. Library-independent BST utilizing the Bacteroidales PCR genetic test will be combined with limited library-dependent BST utilizing the ERIC-PCR and RP combination method. The Texas Known Source Library may need to be supplemented with known fecal samples from the study area. NETMWD will collect duplicate water samples from a subset of those collected through Task 5 and provide to SAML for BST. Additionally, NETMWD will collect known fecal samples, if needed.

NETMWD will collect information to be used to evaluate factors affecting attainment of recreational uses in the waterbodies in the study area. Methods used shall be consistent with the latest version of the TCEQ staff draft Recreational Use-Attainability Analyses (RUAAs) – Procedures for a Comprehensive RUAA and a Basic RUAA Survey.

NETMWD shall conduct a thorough historical information review of the recreational uses of the waterbody back to November 28, 1975.

NETMWD will conduct 2 field surveys at selected sites defined in Appendix G during the period people would most likely be using the waterbody for contact recreation. Field surveys shall ascertain the suitability of the streams for contact recreation use and shall document the hydrological characteristics of the stream, such as width and depth of channel and substantial pools, flow/discharge, and bank access. NETMWD shall collect a digital photographic record of each selected site during the field surveys. To aid in documenting existing uses, NETMWD shall install, operate, and maintain motion-capture cameras at selected monitoring locations. In order to obtain information on existing and historical uses and stream characteristics, NETMWD shall conduct interviews of 1) users present during the field surveys, 2) streamside landowners along the field survey transects, 3) local residents, and 4) commercial providers of outdoor recreation goods and services.

In the interest of generating complete descriptions of all project waterbodies, it is the intent of TSSWCB to fully complete RUAA surveys on waterbodies where obvious primary contact recreation occurs or that may be at other than baseflow conditions. This protocol deviates from the guidance in the latest version of the TCEQ staff draft *Procedures for a Comprehensive RUAA and a Basic RUAA Survey* which suggests terminating the survey when such conditions are encountered.

See Appendix B for the project-related work plan tasks related to data collection and schedule of deliverables for a description of work defined in this QAPP.

See Section B1 for monitoring to be conducted under this QAPP.

Revisions to the QAPP

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The most recently approved QAPPs shall remain in effect until revisions have been fully approved; re-issuances (i.e., annual updates) must be submitted to the TSSWCB for approval before the last version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and organization's policy, the annual reissuance may be done by a certification that the plan is current. This can be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Amendments

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives, and methods; address deficiencies and non-conformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the NETMWD Project Manager to the TSSWCB Project Manager in writing. The changes are effective immediately upon approval by the TSSWCB Project Manager and Quality Assurance Officer.

Amendments to the QAPP and the reasons for the changes will be documented, and revised pages will be forwarded–to all persons on the QAPP distribution list by the WMS QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process or within 120 days of the initial approval in cases of significant changes.

A7 Quality Objectives and Criteria

Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error.

Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Laboratory precision is assessed by comparing replicate analyses of sample/duplicate pairs in the case of bacterial analysis. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Table A7.1.

Representativeness

Site selection, the appropriate sampling regime, the sampling of all pertinent media, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Water quality data that are collected on a routine frequency are separated by approximately even time intervals. Although data may be collected during varying regimes of weather and flow, the data sets will not be biased toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the water body will be tempered by the potential funding for complete representativeness.

Representativeness is a measure of how accurately a monitoring program reflects the actual water quality conditions and recreational uses. The representativeness of the data is dependent on the sampling locations, the conditions under which surveys are performed, and the survey procedures. According to TCEQ guidance, the RUAA field surveys would ideally be performed at a frequency of three sites per five stream miles. This would assure maximum capture of stream recreational uses. Additionally, sites will be surveyed preferentially during high recreational use potential, both temporally and hydrologically. The final determination of the applicability of individual and collective site recreational use conditions will be made in the Technical Report.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project that 90% data completion is achieved.

Comparability

Confidence in the comparability of data sets for this project is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP. Comparability is

also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Limit of Quantitation

AWRLs (Table A7.1) are used in this project as the *limit of quantitation* specification, so data collected under this QAPP can be compared against the TSWQS. Laboratory *limits of quantitation* (Table A7.1) must be at or below the AWRL for each applicable parameter.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5. RiboPrinting, ERIC-PCR, and *Bacteroidales* PCR procedures are included in TSSWCB Project 09-55: *Modeling Support and Bacterial Source Tracking For Big Cypress Creek Bacteria Assessment QAPP*.

Table A7.1 Measurement Performance Specifications for Instream and Effluent Monitoring

Parameter	Units	Matrix	Method	Parameter Code	AWRL	LOQ	Recovery at LOQ (%)	Precision (RPD of LCS/LCSD)	Bias % Rec. of LCS	Completeness (%)
pH	standard units	water	SWQM Vol. 1	00400	NA	NA	NA	NA	NA	90
DO	mg/L	water	SWQM Vol. 1	00300	NA	NA	NA	NA	NA	90
Specific Conductance	µS/cm	water	SWQM Vol. 1	00094	NA	NA	NA	NA	NA	90
Temperature	°C	water	SWQM Vol. 1	00010	NA	NA	NA	NA	NA	90
Flow	cfs	water	TCEQ SOP	00061	NA	NA	NA	NA	NA	90
Flow Measurement Method	1=gage; 2=electric; 3=mechanical; 4=weir/flume; 5=doppler	water	SWQM Vol. 1	89835	NA	NA	NA	NA	NA	90
Flow severity	1=no flow; 2=low; 3=normal; 4=flood; 5=high; 6=dry	water	TCEQ SOP V1	01351	NA	NA	NA	NA	NA	90
Present Weather	1=clear; 2=partly cloudy; 3=cloudy; 4=rain; 5=other	NA	TCEQ SOP V1	89966	NA	NA	NA	NA	NA	90
Wind Intensity	1=calm; 2=slight; 3=moderate; 4=strong	NA	TCEQ SOP V1	89965	NA	NA	NA	NA	NA	90
Days since last significant rainfall	days	NA	TCEQ SOP V1	72053	NA	NA	NA	NA	NA	NA
E. coli	MPN/100ml	water	Colilert System	31699	1	1	NA	0.53	NA	90
Holding time *E. coli* IDEXX Colilert	Extended holding hours	water	NA	31704	NA	NA	NA	NA	NA	90

Table A7.1 (cont.)

Parameter	Method Type	Method	Method Description	Precision Of Laboratory Duplicates[1]	Bias[1]	Percent Complete[2]
E. coli isolation [3]	Membrane filter culture on modified mTEC agar	USEPA 1603	Membrane Filter	N/A	N/A	N/A

Notes:

[1] Bias and laboratory method precision will be determined using isolates from known-source samples in a blind procedure, as discussed in Section B5.

[2] The objective is for 90% of the data to be collected. An additional objective for BST completeness is that sources for 70% of host-specific isolates can be identified.

[3] Laboratory procedures included TSSWCB Project 09-55: *Modeling Support and Bacterial Source Tracking for Big Cypress Creek Bacteria Assessment Quality Assurance Project Plan.*

References:

USEPA *Methods for Chemical Analysis of Water and Wastewater*, Manual #EPA-600/4-79-020.

American Public Health Association, American Water Works Association and Water Environment Federation, *Standard Methods for the Examination of Water and Waste Water*, 20th Ed.

*TCEQ SWQM Procedures, Volume **1:** Physical and Chemical Monitoring Methods, 2008 (RG-415)*

A8 Special Training/Certification

Field personnel receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA Officer (or designee) their ability to properly calibrate field equipment and perform field sampling and analysis procedures. Field personnel training is documented and retained in the personnel file and will be available during a monitoring systems audit.

Contractors and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in section 5.4.4 of the NELAC standards (concerning Review of Requests, Tenders and Contracts).

Field personnel will receive training on the calibration and operation of the YSI multi-parameter sonde, SonTek FlowTracker, SonTek RiverCat, and On-Set pressure transducers.

A9 Documents and Records

The documents and records that describe, specify, report, or certify activities are listed. The list below is limited to documents and records that may be requested for review during a monitoring systems audit.

Field Documentation

Field documentation will involve recording all instrument calibration/standards records, field measurements, and site characteristics on the forms supplied. There are separate forms for wet-chemistry, and field monitoring (See Appendix C).

All field notes will be written on the field forms. Any difficulties or unusual events encountered during sampling will be so noted and reviewed by the WMS QAO during their review. Once the sampling trip concludes, these field forms will be submitted to WMS for review and data entry. The field forms will be scanned and stored at WMS for the time period indicated in Table A9.1. All paper field forms and electronic copies will be submitted to NETMWD on an annual basis for records management.

RUAA Reports and Forms

A RUAA report will be compiled in accordance with the TCEQ *Recreational Use-Attainability Analyses (RUAAs) – Procedures for a Comprehensive RUAA and a Basic RUAA Survey, May 2009.*

RUAA forms will include:

- Contact Information Form from the latest version of the TCEQ *Procedures for a Comprehensive RUAA and a Basic RUAA Survey*
- Field Data Sheets and Data Summary in electronic format
- Digital photographic record, cataloged in an appropriate manner
- Interview Forms and Data Summary in electronic format

Laboratory Test Reports

Test/data reports from the laboratory will document the test results clearly and accurately. Routine data reports will be consistent with the NELAC standards (Section 5.5.10) and include the information necessary for the interpretation and validation of data.

The information in test reports will be consistent with the information that is needed to prepare data submittals to TSSWCB.

Reports will be consistent with the NELAC standards and will include any additional information critical to the review, verification, validation, and interpretation of data.

Electronic Data

Data will be submitted to the TSSWCB in the event/result format specified in the *TCEQ Data Management Reference Guide* (DMRG) for transfer to TCEQ and upload to the Surface Water

Quality Monitoring Information System (SWQMIS). The Data Summary as contained in Appendix C of this document will be submitted with the data.

No measurement data collected for the RUAA field surveys will be submitted by TSSWCB to TCEQ for the express purpose of inclusion in SWQMIS.

A station location request (SLOC) will be submitted to TCEQ for each sampling site in order to obtain a station identification number.

All reported Events will have a unique TagID (see DMRG). TagIDs used in this project will be seven-character alphanumerics with the structure of the two-letter Tag prefix followed by a five digit number.

Reporting Entity, Monitoring Entity, and Monitoring Type will reflect the project organization and monitoring type in accordance with the DMRG. The proper coding of Monitoring Type is essential to accurately capture any bias toward certain environmental condition (for example, high flow events). The TSSWCB QAO should be consulted to assure proper use of the Monitoring Type code.

Data Maintenance

WMS will transfer all original field sheets and laboratory reports to NETMWD on an annual basis and will maintain scanned electronic copies for the time period indicated in Table A9.1. All hard copy records will be maintained by NETMWD until they are destroyed after five years. This will include paper copies of all analytical data, field data forms, field notebooks, and field instrument calibration notebooks. All data results will be maintained electronically as determined by the Data Management guidelines (See Section B10). All field and laboratory audit results and corrective action reports will be maintained by NETMWD. Data from sub-tier participants will be submitted to the WMS electronically and via hard copy. Electronic data will be stored at WMS for the duration defined and hard copy data submitted to WMS from sub-tier participants will be transferred to NETMWD on an annual basis.

Records and Documents Retention Requirements

Table A9.1 Records and Documents Retention Requirements

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TSSWCB/NETMWD/WMS*	5	Paper/Paper/Electronic
Field SOPs	NETMWD/WMS*	5	Paper/Electronic
Laboratory Quality Manuals	ANA-LAB/WMS*	5	Paper/Electronic
Laboratory SOPs	ANA-LAB/WMS*	5	Paper/Electronic
QAPP distribution documentation	NETMWD/WMS*	5	Paper/Electronic
Field staff training records	NETMWD/WMS*	5	Paper/Electronic
Field equipment calibration/maintenance logs	WMS*	5	Electronic
RUAA Contact Information, Field Data, and Interview Forms	NETMWD/WMS*	5	Paper/Electronic
Field instrument printouts	WMS*	5	Electronic
Field notebooks or data sheets	WMS*	5	Electronic
Chain of custody records	NETMWD/WMS*	5	Paper/Electronic
Laboratory calibration records**	ANA-LAB	5	Paper
Laboratory instrument printouts**	ANA-LAB	5	Paper
Laboratory data reports/results**	NETMWD/WMS*/ANA-LAB	5	Paper/Electronic/Paper
Laboratory equipment maintenance logs**	ANA-LAB	5	Paper
Corrective Action Documentation	NETMWD/WMS*/ANA-LAB	5	Paper/Electronic/Paper

* WMS to retain electronic records only. All paper documents will be transferred to NETMWD on an annual basis.
** Laboratory Records must be retained in accordance with the NELAC standards.

B1 Sampling Process Design (Experimental Design)

To provide sufficient water quality data to characterize bacteria loadings across the various flow regimes, NETMWD will conduct routine ambient monitoring at 14 sites once every two weeks. NETMWD will conduct effluent monitoring at the outfalls of 2 wastewater treatment facilities (WWTFs) once every two weeks in an effort to estimate possible contributions from wastewater discharges. NETMWD will conduct biased-flow monitoring under high flow (storm event influenced) conditions at the 14 stream sites and the 2 WWTFs during at least 8 storm events.

The intent of event-based sampling is to monitor the impact of non-point sources on water quality during and immediately following a significant runoff event. Storm samples will be collected only after an extended period of time without substantial rainfall or significant runoff. Event-based sampling will occur no more frequently than once every 30 days and storm sampling will be spread throughout the study period. No more than five storm events will be sampled per year, unless drought or other conditions necessitate modifications to these guidelines. If such conditions arise, a request to modify the sampling regime will be submitted to the TSSWCB Project Manager for approval.

Coordination between TPDES permittees and the TCEQ Regional Office will be required. Neither NETMWD nor TSSWCB shall submit WWTF data to TCEQ for use in permit compliance and enforcement; rather, WWTF data will only be used to estimate bacteria loadings from wastewater discharges and to assist TPDES permittees in improving management and operations.

NETMWD will establish, and maintain, continuous flow monitoring gages in Hart Creek, Tankersley Creek, Walkers Creek and Prairie Branch. These sites shall be located as close to the confluence with Big Cypress Creek as is feasible. A barometric pressure logger will be installed and maintained at one station and the data will be used to compensate stage data for barometric pressure. Continuous flow at these stations will extend over 22 months. Additionally, continuous flow reported for USGS gages on Big Cypress Creek at US 271 and SH 11 will be included in the data record.

Field data and samples will be collected following procedures detailed in the *TCEQ SWQM Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2008 (RG-415).*

Samples collected by NETMWD will be delivered to Ana-Lab for processing and analysis; Ana-Lab will provide a subset of collected water samples to SAML for BST analysis (Table B1.1). SAML will perform Bacteroidales PCR on approximately 250 individual water samples collected between August 2009 and May 2011. The samples will include: 1) 12 sample events for each of the 14 stream sites; 2) 9 sample events for each of the 2 WWTFs; and 3) 4 sample events for each of the 14 stream sites and 2 WWTFs during storm events. SAML will also isolate and fingerprint (ERIC-RP) *E. coli* (one per site per sample event) from each of the 14 stream sites and 2 WWTFs for 4 sample events and also 2 storm events; this results in a total of 100 individual samples analyzed using ERIC-PCR.

NETMWD will collect information that can be used to evaluate recreational uses in the waterbodies in the study area. Methods used and sampling process design shall be consistent with the latest version of the TCEQ *Procedures for a Comprehensive RUAA and a Basic RUAA Survey*. NETMWD will conduct field surveys at selected sites during the period people would most likely be using the waterbody for contact recreation; surveys shall ascertain the suitability of the streams for contact recreation use and shall document the hydrological characteristics of the stream.

Table B1.1 Monitoring Sites and Samples to be Analyzed using *Bacteroidales* PCR and ERIC-RP

Segment	Site Number	Site Description	Latitude Longitude	Sample Matrix	Monitoring Frequencies				
					Field	Flow	*E. coli*	Biased Flow	Continuous Flow
0404B	18326	Dragoo Creek at Titus CR 2400	33.15724 -95.027	Water	44*	44*	44*	8**	--
0404B	10264	Tankersley Creek at FM 899	33.155369 -95.003694	Water	44*	44*	44*	8**	--
0404B	10263	Tankersley Creek at FM 127	33.138371 -94.997661	Water	44*	44*	44*	8**	--
0404B	10261	Tankersley Creek at FM 3417	33.095894 -94.986475	Water	44*	44*	44*	8**	22 months
0404	10310	Big Cypress Creek at US 271	33.072987 -94.965431	Water	44*	44*	44*	8**	22 months[+]
0404K	16454	Walkers Creek at US 271	33.051731 -94.960789	Water	44*	44*	44*	8**	22 months
0404C	EV01	Evans Creek at US 67	33.18587 -94.91866	Water	44*	44*	44*	8**	--
0404C	HC01	Hayes Creek at US 67	33.17326 -94.95063	Water	44*	44*	44*	8**	--
0404C	10273	Hart Creek at US 67	33.176048 -94.942108	Water	44*	44*	44*	8**	--
0404C	10272	Hart Creek at SH 49	33.142319 -94.938389	Water	44*	44*	44*	8**	--
0404C	10266	Hart Creek at CR SE-12	33.094185 -94.944356	Water	44*	44*	44*	8**	22 months
0404	UT01	Unnamed BCC trib at Dukes Chapel Rd	33.03612 -94.91969	Water	44*	44*	44*	8**	--
0404J	PB01	Prairie Branch at FM 2348	33.05159 -94.8869	Water	44*	44*	44*	8**	22 months
0404	10308	Big Cypress Creek at SH 11	33.01973 -94.883558	Water	44*	44*	44*	8**	22 months[+]
0404C	16467	City of Mt. Pleasant WWTF †	33.10416 -94.948156	Water	44*	44*	44*	8**	--
0404B	16468	Pilgrim's Pride Processing WWTF †	33.139095 -94.995322	Water	44*	44*	44*	8**	--

* Sampling (instream and WWTF) once every two weeks from August 2009 through May 2011
** Storm events sampled over 22 months (August 2009 through May 2011)
[+] Data obtained from USGS gage
† Pending authorization from the WWTF operators and TCEQ

Table B1.1. (continued)

	'X' denotes a single sampling event [1]	**2009**				**2010**								**Total # Samples**
	Parameter	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Bacteroidales														
250 Samples	Stream (14)	X	X	X	X	X	X	X	X	X	X	X	X	168
	WWTFs (2)	X	X	X		X		X	X	X	X		X	18
	Storm - Stream (14)[2]	X			X			X			X			56
	Storm - WWTFs (2)	X			X			X			X			8
E. coli (ERIC-RP)														
100 Samples	Stream (14)	X			X			X			X			56
	WWTFs (2)	X	X		X			X	X		X			12
	Storm - Stream (14)[2]				X						X			28
	Storm - WWTFs (2)				X						X			4

[1] An **'X'** denotes one complete subset (1 sample collected from each site) of samples collected to be analyzed for respective BST analysis.

[2] Approximately one storm event sample will be analyzed per site per quarter using *Bacteroidales* PCR and every other quarter using ERIC-RP. Storm sampling timeframe may also vary depending on the timing of run-off producing storms.

B2 Sampling Methods

Field Sampling Procedures

Field sampling, staff gauge installation, and development of flow rating curves will be conducted according to procedures documented in the *TCEQ SWQM Procedures Volume 1: Physical and Chemical Monitoring Methods, 2008 (RG-415).*

WMS will install staff gauges at 12 stream sites where a USGS gage is not present. During the initial set up, the site will be surveyed prior to installing the staff gauge. At stations where a staff gauge cannot be permanently installed (such as being attached to a concrete bridge pier), a local datum/benchmark will be referenced, marked and recorded in the field notes during the staff gauge installation. The datum will not be referenced to elevation, but GPS coordinates will be recorded for the benchmark. The datum is necessary in order to reinstall or replace a damaged staff gauge. After the survey is completed and the staff gauge is installed, a flow measurement will be made.

Additional flow measurements will be made at each station at least four times per year. The measurements will be made during various flow regimes (low, normal and high) in order to develop and refine a rating curve for each station. A discharge measurement will not be made by the field technician at the time of sample collection at these sites; however, the stage shown on the staff gauge will be recorded onto the field sheet. (Discharge reported for the USGS gage stations and the WWTFs will be recorded on the field sheet at the time of sample collection.) After the rating curve is developed, the stage reported on the field sheets will be converted to discharge. The rating curve development process may take several months to complete depending upon the amount of rainfall received in the watershed and the frequency of runoff events.

WMS will make all flow measurements using acoustic Doppler meters unless water is too shallow to use a Doppler instrument. In extremely shallow water, a cut-throat flume will be used to measure discharge. At wadable stations, WMS will use a SonTek FlowTracker ADV. At sites too deep to wade, measurements will be made using a SonTek RiverSurveyor. Flow measurements will be made following the guidelines outlined in the *TCEQ SWQM Procedures Volume 1: Physical and Chemical Monitoring Methods, 2008 (RG-415)* and the procedures listed in Appendix E.

WMS will establish, and maintain, continuous water level recorders in Hart Creek, Tankersley Creek, Walkers Creek and Prairie Branch. These sites will be located as close to the confluence with Big Cypress Creek as is feasible. An additional site may be added in Tankersley Creek below Tankersley Lake if releases from the reservoir are not continuously recorded. Average daily discharge will be calculated from the hourly stage data recorded by non-vented pressure transducers installed at these sites. Average daily discharge for USGS gage #07344493 (Big Cypress Creek at US271) and USGS gage #07344500 (Big Cypress Creek at SH11) will be recorded.

WMS will install pressure transducers inside a stilling well at each continuous monitoring station. The stilling well will be constructed of PVC with holes drilled in the pipe to allow water to flow through it. WMS will download the transducers monthly and perform routine site maintenance as needed. Routine maintenance will include removing debris from the staff gauge,

replacing instrument batteries, and cleaning sediment out of the stilling well. The water level shown on the staff gauge will be recorded each time the site is serviced. A barometric pressure logger will be installed at one of the continuous flow stations located near the central portion of the watershed. Barometric pressure data will be recorded hourly and downloaded monthly. This information will be used to compensate stage data for barometric pressure changes prior to conversion to discharge.

All routine and biased-flow monitoring will be conducted by NETMWD. Field data and bacteria samples will be collected at all stream sites. Field parameters will not be measured at the WWTFs. Field parameters for temperature, specific conductance, pH and DO will be obtained using a YSI Model 600XLM multi-parameter sonde. All bacteria samples will be collected mid-channel and upstream of bridge and road crossings. The sample will be collected at 0.3 meter depth or at mid-depth if the stream or WWTF outfall is less than 0.3 meter deep. At most stations, bacteria samples will be collected from the bridge or stream bank directly into the sample bottle attached to the end of a telescoping pole. At sites where samples are collected by the technician entering the stream, the sample will be collected upstream of the technician and away from disturbed sediments. All samples will be collected directly into a pre-cleaned bottle and labeled according to section B3 of the QAPP.

NETMWD will conduct biased-flow monitoring under high flow conditions at the 14 stream sites and the 2 WWTFs during at least 8 storm events. Field parameters will be obtained at the stream stations only. Event-based samples should be collected after an extended period of time without substantial rainfall or runoff. For the purposes of this study, a substantial storm event will be defined as more than 1” rain in eight hours or a 10% or greater increase in flow in Big Cypress Creek. Rainfall reported for USGS Gage #0734489 (Lake Bob Sandlin near Mt. Pleasant) and flow from USGS Gage #07344500 (Big Cypress Creek at SH11) will be used to make this determination. Event-based sampling may be conducted when either of these conditions exists. Samples will not be collected more frequently than once every 30 days. Storm sampling will also be spread throughout the study period with no more than five events per year, unless drought or other conditions necessitate a modification to these guidelines.

All ambient and event-based *Bacteroidales* and BST samples will be collected by NETMWD at the time of *E. coli* sample collection. These samples will be delivered to Ana-Lab within the specified holding times.

Daily rainfall totals reported for USGS Gage #0734489 will be recorded and will be used for reference and data analysis purposes.

The sample volumes, container types, minimum sample volume, preservation requirements, and holding time requirements are specified in table B2.

BST samples will only be taken when water is flowing, and the flow severity at the time of sample collection will be recorded on the field data sheet. If water is pooled but not flowing or if the stream is dry, BST samples will not be collected. Water samples will be collected directly from the stream at mid-channel into containers as specified in Table B2.1. The sample container will be held upstream of the sampler and care will be taken to avoid contact with sediment and

the surface micro layer of water. All samples will be transported in an iced container to Ana-Lab for analysis. A subset of water samples will be processed and shipped to SAML along with appropriate Chain of Custody forms (Appendix C).

For the RUAA field surveys, information to be collected shall at least satisfy those questions found on the Field Data Sheet from the most recent version of the TCEQ *Procedures for a Comprehensive RUAA and a Basic RUAA Survey*.

Table B2.1 Instream and Effluent Monitoring

Parameter	Matrix	Container	Preservation	Temp.	Sample Size	Holding Time
E. coli	water	IDEXX bottle	Ice, dark	4°C	100 ml	8 hours[1]
E. coli water isolates	NA- MUG agar	Petri dish 100mm x 15mm	20% glycerol; 80% tryptic soy broth	44.5°C	5 colony streaks	20 – 24 hrs, then frozen indefinitely
Bacteroidales	Supor filters	15 ml centrifuge tube	GITC buffer	4°C	100 ml	6 hours[1], filters indefinitely

[1] 8 hours to deliver to laboratory. In the case that this 8-hour holding time is not met, the *E. coli* quantitative count will be flagged and not reported, though the *Bacteroidales* PCR will still be valid.

Processes to Prevent Cross Contamination

Procedures outlined in the *TCEQ SWQM Procedures Volume 1* outline the necessary steps to prevent cross-contamination of samples. These include such things as direct collection into sample containers and the use of commercially pre-cleaned sample containers.

Documentation of Field Sampling Activities

Field sampling activities are documented on the Field Data Sheet as presented in Appendix F. For all visits, station ID, location, sampling time, sampling date, sampling depth, preservatives added to samples, and sample collector's name/signature are recorded. Values for all measured field parameters are recorded. Detailed observational data are recorded including water appearance, weather, biological activity, stream uses, unusual odors, specific sample information, missing parameters, days since last significant rainfall, and flow severity.

The following will be recorded for all visits:

1. Station ID
2. Sampling Date
3. Station Description
4. Sampling depth
5. Sampling time
6. Sample collector's name/signature
7. Values for all field parameters
8. Detailed observational data, including:
    a. water appearance
    b. weather
    c. biological activity
    d. unusual odors
    e. pertinent observations related to water quality or stream uses (e.g., exceptionally poor water quality conditions/standards not met; stream uses such as swimming, boating, fishing, irrigation pumps, etc.)
    f. watershed or instream activities (events impacting water quality, e.g., bridge construction, livestock watering upstream, etc.)
    g. specific sample information

h. missing parameters (i.e., when a scheduled parameter or group of parameters is not collected)

Field sampling activities for recreational use attainability tasks are documented on the Field Data Sheets, Interview Forms, and Summary Sheets as specified by the most recent version of the TCEQ *Procedures for a Comprehensive RUAA and a Basic RUAA Survey*. Versions of these forms for this project are found in Appendix F.

Recording Data

For the purposes of this section and subsequent sections, all personnel follow the basic rules for recording information as documented below:

1. Legible writing in indelible, waterproof ink with no modifications, write-overs or cross-outs;
2. Changes should be made by crossing out original entries with a single line, entering the changes, and initialing and dating the corrections.
3. Close-outs on incomplete pages with an initialed and dated diagonal line.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies which affect quality and render the data unacceptable or indeterminate. Deficiencies related to sampling methods requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sample site adjustments.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the WMS QAO. The WMS QAO will notify the WMS Project Manager of the potential nonconformance within 24 hours. The staff member identifying the deficiency will initiate a record on the Deficiency Worksheet to document the deficiency.

The WMS QAO, in consultation with WMS Project Manager (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the deficiency worksheet will be completed accordingly. If it is determined a nonconformance does exist, the WMS QAO in consultation with WMS Project Manager will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the WMS QAO by completion of a NR.

NRs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. NRs will be included with quarterly progress reports. In addition,

significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B3 Sampling Handling and Custody

Sample Labeling

Samples will be labeled on the container with an indelible, waterproof marker. Label information includes:

1. Sample Number, Bottle Letter, and Site Number
2. Date and time of collection
3. Sample Depth
4. Initials of collector

The COC form will accompany all sets of sample containers.

Sample Handling

Samples are collected in the field and stored in coolers on ice. Samples are delivered to the water quality laboratory in coolers with field data sheets (COC Forms) attached. The laboratory staff examines each sample container for anomalies and ensures that all container information matches the information on the appropriate field data sheet. If the information is present and correct, the Ana-Lab staff will receive the samples by signing the field data sheet "received by" block and entering the samples into the laboratory sample log book. At this instant, the samples become the responsibility of the Ana-Lab water quality laboratory.

Sample Tracking

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The field data sheet serves as the COC form to document sample handling during transfer from the field to the laboratory. The following information concerning the sample is recorded on the field data sheet form (See Appendix F).

1. Date and time of collection
2. Site identification
3. Sample matrix
4. Number of containers
5. Residual chlorine
6. Preservative used
7. Was the sample filtered
8. Analyses required
9. Name of collector
10. Custody transfer signatures and dates and time of transfer

Deficiencies, Nonconformances and Corrective Action Related to Chain-of Custody

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies which affect quality and render the data unacceptable or indeterminate. Deficiencies related to chain-of-custody include but are not limited to delays in transfer, resulting in holding time violations; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the WMS QAO. The WMS QAO will notify the WMS Project Manager of the potential nonconformance within 24 hours. The staff member identifying the deficiency will initiate a record on the Deficiency Worksheet to document the deficiency.

The WMS QAO, in consultation with WMS Project Manager (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the deficiency worksheet will be completed accordingly. If it is determined a nonconformance does exist, the WMS QAO in consultation with WMS Project Manager will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the WMS QAO by completion of a NR.

NRs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. NRs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B4 Analytical Methods

The analytical methods are listed in Table A.1 of Section A7. Laboratories collecting data under this QAPP are compliant with the NELAC Standards, where applicable.

Copies of laboratory SOPs are retained by Ana-Lab Corporation and are available for review by the TSSWCB. Laboratory SOPs are consistent with EPA requirements as specified in the method.

Standards Traceability

All standards used in the field and laboratory are traceable to certified reference materials. Standards and reagent preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard or reagent identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer's initials/signature. The bottle is labeled in a way that will trace the standard or reagent back to preparation. Standards or reagents used are documented each day samples are prepared or analyzed.

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies which affect quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include but are not limited to instrument malfunctions, blank contamination, quality control sample failures, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the WMS QAO. The WMS QAO will notify the WMS Project Manager of the potential nonconformance within 24 hours. The staff member identifying the deficiency will initiate a record on the Deficiency Worksheet to document the deficiency.

The WMS QAO, in consultation with WMS Project Manager (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the deficiency worksheet will be completed accordingly. If it is determined a nonconformance does exist, the WMS QAO in consultation with WMS Project Manager will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the WMS QAO by completion of a NR.

NRs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. NRs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious

effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

Table A7.1 lists the required accuracy, precision, and completeness limits for the parameters of interest. It is the responsibility of the WMS DM to verify that the data are representative. All incidents requiring corrective action will be documented through use of CARs. Laboratory audits, sampling site audits, and QA of field sampling methods will be conducted by the TSSWCB QAO or their designee.

Field Split - A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples according to procedures specified in the *TCEQ SWQM Procedures, Volume 1*. Split samples are preserved, handled, shipped, and analyzed identically and are used to assess variability in all of these processes. Field splits are collected for 10 percent of samples.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Method Specific QC requirements – QC samples, other than those specified later this section, are run (e.g., sample duplicates, positive control, negative control, and media blank) as specified in the methods. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory QAMs. The minimum requirements that all participants abide by are stated below.

Laboratory Duplicates – A laboratory duplicate is prepared by taking aliquots of a sample from the same container under laboratory conditions and processed and analyzed independently.

A bacteriological duplicate is considered to be a special type of laboratory duplicate. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Measurement performance specifications are used to determine the acceptability of duplicate analyses as specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations >10 MPN/100mL.

Laboratory Blanks

Laboratory blanks, or negative controls, consist of 100-ml aliquots of sterile distilled water that are processed in the same manner as a field sample, at the beginning and the end of a sample set. They are used to assess the sterilization techniques employed throughout the sample process. Laboratory blanks will be included at the beginning and the end of the sample set for each sampling event. The analysis of laboratory blanks should yield a value of no colonies detected. For *Bacteroidales* PCR, a laboratory blank will be analyzed with each batch of samples to ensure

no cross-contamination occurs during sample processing. In addition, negative controls will be analyzed for each batch of PCR samples.

Positive Control

Positive controls will be analyzed by SAML for each batch of *E. coli* ERIC-PCR and RiboPrinting, and *Bacteroidales* PCR samples. SAML will maintain live *E. coli* in tryptic soy broth and kept refrigerated until needed. Each time a set of samples is run a positive control will be performed in the lab using the same media and 1 ml of live *E. coli* which will be added to 99 ml of sterile distilled water that will be run through the filter funnel system and the filter placed on the media. This control should always be positive for *E. coli* after recommended incubation time. In addition, positive controls will be analyzed for each batch of *E. coli* ERIC-PCR and RiboPrinting, and *Bacteroidales* PCR.

Laboratory Duplicate

Laboratory duplicates are used to assess precision. A laboratory duplicate is prepared by splitting aliquots of a single sample (or a matrix spike or a laboratory control standard) in the laboratory. Both samples are carried through the entire preparation and analytical process. Laboratory duplicates are run at a rate of one per batch. Acceptability criteria are outlined in Table A7.1 of Section A7.

Precision is calculated by the relative percent difference (RPD) of duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, the RPD is calculated from the following equation:

$$\mathbf{RPD = \frac{(X_1 - X_2) \times 100}{(X_1 + X_2) \div 2}}$$

A bacteriological duplicate is considered to be a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the laboratory. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair. Performance limits and control charts are used to determine the acceptability of duplicate analyses. Precision limits for bacteriological analyses are defined in Table A7.1 and applies to samples with concentrations >10 cfu/100 ml.

Failures in Quality Control and Corrective Action

Notations of blank contamination will be noted in QPRs and the final report. Corrective action will involve identification of the possible cause (where possible) of the contamination failure. Any failure that has potential to compromise data validity will invalidate data, and the sampling event should be repeated. The resolution of the situation will be reported to the TSSWCB in the QPR. The CARs will be maintained by the SCSC Project Leader and the TSSWCB PM.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviation from procedures documented in the QAPP. Nonconformances are deficiencies which affect quality and render the data unacceptable or indeterminate. Deficiencies related to Quality Control include but are not limited to quality control sample failures.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the WMS QAO. The WMS QAO will notify the WMS Project Manager of the potential nonconformance within 24 hours. The staff member identifying the deficiency will initiate a record on the Deficiency Worksheet to document the deficiency.

The WMS QAO, in consultation with WMS PM (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore is not a valid nonconformance, the deficiency worksheet will be completed accordingly. If it is determined a nonconformance does exist, the WMS QAO in consultation with WMS PM will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the WMS QAO by completion of a NR.

NRs document: root cause(s); programmatic impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. NRs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TSSWCB immediately both verbally and in writing.

B6 Instrument/Equipment Testing, Inspection and Maintenance

Flow gauge testing and maintenance requirements are contained with Appendix E of this document.

All instream sampling equipment testing and maintenance requirements are detailed in the *TCEQ SWQM Procedures, Volume 1*. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained by the WMS Technical Coordinator.

BST Analysis:
To minimize downtime of all measurement systems, spare parts for laboratory equipment will be kept in the laboratory, and all laboratory equipment must be maintained in a working condition. All laboratory equipment will be tested, maintained, and inspected in accordance with manufacturer's instructions and recommendation in *Standard Methods for the Examination of Water and Wastewater, 21st Edition*. Maintenance and inspection logs will be kept on each piece of laboratory equipment.

Records of all tests, inspections, and maintenance will be maintained and log sheets kept showing time, date, and analyst signature. These records will be available for inspection by the TSSWCB.

Failures in any testing, inspections, or calibration of equipment will result in a NR and resolution of the situation will be reported to the TSSWCB in the QPR. The NRs will be maintained by the SCSC Project Leader and the TSSWCB PM.

Table B6.1. Equipment Inspection and Maintenance Requirements

Equipment	Relevant Testing, Inspection & Maintenance Requirement
Thermometers	SM 9020 B 3.a
PCR Thermal cycler	Per manufacturer & annual preventative maintenance
RiboPrinter	Per manufacturer & annual preventative maintenance
Water deionization units	SM 9020 B 3.d
Media dispensing apparatus	SM 9020 B 3.f
Autoclaves	SM 9020 B 3.h
Refrigerator	SM 9020 B 3.i
Ultra Low Freezer	SM 9020 B 3.j
Membrane filter equipment	SM 9020 B 3.k
Ultraviolet sterilization lamps	SM 9020 B 3.l
Biological safety cabinet	SM 9020 B 3.m
Incubators	SM 9020 B 3.o
Glassware and plastic ware	SM 9020 B 4.a
Utensils and containers	SM 9020 B 4.b
Dilution water bottles	SM 9020 B 4.c

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QAMs. Testing and maintenance records are maintained and are available for inspection by the TSSWCB. Instruments requiring daily or in-use testing may

include, but are not limited to, water baths, ovens, incubators, refrigerators, and laboratory pure water. Critical spare parts for essential equipment are maintained to prevent downtime. Maintenance records are available for inspection by the TSSWCB.

B7 Instrument/Equipment Calibration and Frequency

Operation procedures for the SonTek Doppler FlowTracker ADV are included in Appendix F of this document. Operation procedures for the SonTek RiverCat are included in Appendix F.

YSI, Inc. calibration requirements are contained in the *TCEQ SWQM Procedures, Volume 1*. Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidates associated data collected subsequent to the pre-calibration and are not submitted to the TSSWCB.

Detailed laboratory calibrations are contained within the Ana-Lab QAM.

B8 Inspection/Acceptance of Supplies and Consumables

New batches of supplies are tested and the results recorded in the appropriate logbook before use to verify that they are not contaminated. The Ana-Lab QAM provides additional details on acceptance requirements for laboratory supplies and consumables.

B9 Non-direct Measurements

Historical data will be retrieved from the SWQMIS. Historical data were collected and analyzed consistently with *TCEQ SWQM Procedures, Volume 1* under the SWQM QAPP or CRP QAPP or EPA approved Cypress Creek Basin QAPP and therefore are considered representative of ambient conditions and will be comparable to data collected under this project. Table B9.1 shows the date range of data for each of seven existing sites for which SWQMIS has historical data. The mean and median will be computed for each parameter as well as the number of water quality criteria exceedances, as applicable. This information will be compared statistically to the results of data collected under this project. Due to the historical data's comparability to the data collected under this project, there are not limitations on their use.

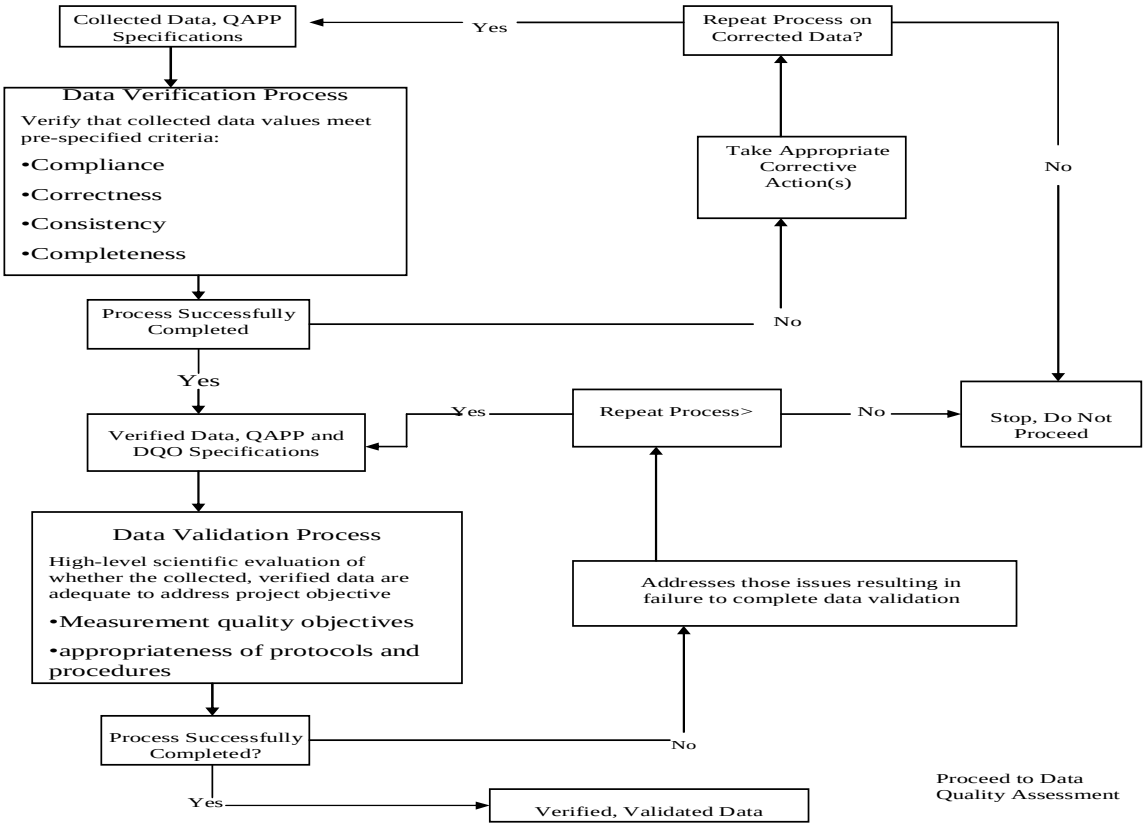
Table B9.1 Historical Data

Site Number	Site Name	Date Range of Historical Data
10261	Tankersley Creek at FM 3417	12/00 – 04/05
10263	Tankersley Creek at FM 127	05/04 – 04/05
10264	Tankersley Creek at FM 889	10/02 – 04/05
10266	Hart Creek at Titus CR SE-12	10/02 – 08/07
10272	Hart Creek at SH 49	10/02 – 08/03
10308	Big Cypress Creek at SH 11	12/00 – 08/07
10310	Big Cypress Creek at US 271	5/07 – 08/07

Additionally, data collected by NETMWD will be collected in accordance with that approved QAPP. Data utilized from this project will include water quality samples collected from designated stream crossings and WWTFs and will be delivered to Ana-Lab for processing within required holding times. Ana-Lab will prepare samples to be shipped to SAML.

B10 Data Management Process

Figure B10.1 Data Flow



Data Path

Samples are collected and are transferred to the laboratory for analyses as described in Sections B1 and B2. Sampling information (e.g. site location, date, time, sampling depth, etc.) is used to generate a unique sampling event in a database. Measurement results from both the field data sheets and laboratory data sheets are manually entered into the database for their corresponding event. Customized data entry forms facilitate accurate data entry. Following data verification and validation, the data are exported from the database to pipe-delimited text files in TCEQ format for reporting to TSSWCB. Upon completion of a data review, TSSWCB will submit these files to TCEQ for entry into SWQMIS.

Record-keeping and Data Storage
WMS will scan and transfer all paper field sheets and laboratory reports to NETMWD on an annual basis and will maintain electronic copies for the time period indicated in Table A9.1. All hard copy records will be maintained by NETMWD until they are destroyed after ten years. This will include paper copies of all analytical data, field data forms, and field instrument calibration notebooks. All field and laboratory audit results and corrective action reports will be maintained by NETMWD. Data from sub-tier participants will be submitted to the WMS electronically and via paper copy.

Data Verification/Validation
The control mechanisms for detecting and correcting errors and for preventing loss of data during data reduction, data reporting, and data entry are contained in Sections D1, D2, and D3.

Laboratory technicians review all data before finalizing data reports, if needed and the sample is still within holding time the technician will reanalyze samples not meeting QA requirements. The Laboratory Manager reviews all data following analysis and checks for calculation errors or data entry errors. The WMS Data Manager performs a third review of data to determine validity within this QAPP.

Data that is not valid, for quality reasons, is rejected by the data manager, and the corresponding data will not be submitted to the TSSWCB.

Forms and Checklists
See Appendix F for the Field Data Sheets, Laboratory Data Sheets, and RUAA forms.
See Appendix C for the Data Summary.

Data Handling, Hardware, and Software Requirements
The data management program will interface with the data users to assure efficient retrieval and manipulation of screened, quality assured data. Staff with data management skills, who have sufficient understanding of database administration and operation to coordinate the data elements needed and manage the available resources, such as trend analysis, web page updates, or public presentation will provide direct support to the various data. Administrative and data management needs can be filled with the use of current staff that have already been given appropriate training. The need for staff at a more specialized skill level is only occasional, and may be met by the use of consultants.

The primary source of data used to satisfy the objectives of the Big Cypress Creek Bacteria Assessment is the descriptive data collected on water quality and natural resources within the project area. This data must be collected by reliable personnel using the established methods described in the TCEQ Program Guidance and specifically adapted to Big Cypress Creek Bacteria Assessment activities in the Quality Assurance Project Plan (QAPP). In addition, the data will be supplemented by acquired data sets, which may be used to establish a regional context, or to evaluate possible correlations between identified water quality problems and their likely sources. These data sets must be screened and assessed for usefulness and credibility before being integrated into the basin assessment report.

The large amount of data involved will need to be readily updateable and efficiently managed. The data must be efficiently sorted and grouped for statistical analysis. The ability to present this data in both a graphic and tabular format may be necessary to effectively communicate both the results and basis for basin assessments to the public. This action requires the procurement and use of software that has the ability to produce both graphics and tables.

The recommended software and hardware required to meet the basic requirements of the program have been identified, and are being utilized by NETMWD and WMS. Program requirements are continually evaluated by NETMWD and its consultants to insure that hardware continue to be adequate to meet those requirements. Criteria for hardware will include performance capable of running anticipated software and potentially useful future software products, as well as storage capacity appropriate to maintain all program-related software, and numerous years of data. Criteria for software will include the capability to manipulate, evaluate, report, and manage data consistent with the basic requirements of the water quality assessments.

Data management procedures have been developed to screen and digitally store data, convert the data received in non-compatible formats to a format suitable for analysis, apply quality control and assurance procedures, provide data access for current and future users of the data, and support assessments of water quality conditions within the basin. These procedures utilize personal computer technology to manage the data associated with the individual tasks of the program.

Once the data has been entered, screened, and quality-checked it will be submitted to TSSWCB in the TCEQ required format for entry into the SWQMIS database. The data will also be transmitted to NETMWD to be maintained for dissemination.

WMS maintains commercial software operating in the Microsoft Windows environment. Microsoft Office, which includes Microsoft Word, Microsoft Excel, and Microsoft Access, is maintained for report preparation, data entry, and exploratory data analysis. Once entered, screened, and quality checked, the data is converted into delimited text files for database storage and transfer to TSSWCB and NETMWD. The NETMWD computer system is a Microsoft Windows based system with Microsoft Office maintained for general report production and correspondence. Additional software similar to that already available at WMS, but not currently maintained by NETMWD, may need to be installed in the future to facilitate data use and manipulation.

Information Resource Management Requirements

Applicable information resource management requirements for the planning agency are satisfied through the utilization of the process outlined in the previous Data Management sections. The TCEQ has the following data specification requirements: the *Surface Water Quality Monitoring Data Management Reference Guide, GIS Policy (TCEQ OPP 8.11)* and *GPS Policy (TCEQ OPP 8.12)*. Note that GPS certification is not required for positional data that will be used for photo interpolation in the SLOC request process.

Data will be managed in accordance with the TCEQ Surface Water Quality Monitoring Data Management Reference Guide and applicable Cypress Basin Planning Agency information resource management policies.

Global Positioning System (GPS) equipment may be used as a component of the information required by the Station Location (SLOC) request process for creating the certified positional data that will ultimately be entered into the TCEQ's SWQMIS database. Any positional data obtained using a GPS will follow the TCEQ's OPP 8.11 and 8.12 policy regarding the collection and management of positional data.

Positional data entered into SWQMIS will be collected by a GPS certified individual with an agency approved GPS device to ensure that the agency receives reliable and accurate positional data. Certification can be obtained in any of three ways: completing a TCEQ training class, completing a suitable training class offered by an outside vendor, or by providing documentation of sufficient GPS expertise and experience. Contractors must agree to adhere to relevant TCEQ policies when entering GPS-collected data.

In lieu of entering certified GPS coordinates, positional data may be acquired with a GPS and verified with photo interpolation using a certified source, such as Google Earth or Google Map. The verified coordinates and map interface can then be used to develop a new Station location.

C1 Assessments and Response Actions

Table C1.1 Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	NETMWD Project Manager	Monitoring of the project status and records to ensure requirements are being fulfilled.	Report to TSSWCB in Quarterly Progress Reports
Laboratory Inspection	At least once per life of the project; dates to be determined by the TSSWCB	Ana-Lab QAO	Analytical and quality control procedures employed at the laboratory	30 days to respond in writing to the TSSWCB to address corrective actions
Monitoring Systems Audit	At least once per life of the project; dates to be determined by TSSWCB	WMS QAO	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Field sampling, handling and measurement; facility review; and data management as they relate to the project	30 days to respond in writing to the TSSWCB to address corrective actions
Site Visit	At least once per fiscal year; dates to be determined by TSSWCB	TSSWCB PM	Status of activities. Overall compliance with work plan and QAPP	As needed

BST Analysis:
The types of assessments and response actions for data collection activities and corrective action applicable for the QAPP for SAML are detailed in the Project 09-55 QAPP (Table C1.1).

The types of assessments and response actions for data collection activities and corrective action applicable for the QAPP for BAEN are detailed in the Project 09-55 QAPP (Table C1.2).

Corrective Action
The WMS QAO is responsible for implementing and tracking corrective action procedures as a result of audit findings. Records of audit findings and corrective actions are maintained by both the TSSWCB PM and the WMS QAO.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work is specified in the TSSWCB QMP and in agreements or contracts between participating organizations.

C2 Reports to Management

Reports to TSSWCB Project Management

All reports detailed in this section are contract deliverables and are transferred to the TSSWCB in accordance with contract requirements.

Quarterly Progress Report – Summarizes the NETMWD activities for each task; reports problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Final Project Report – Summarizes the NETMWD activities for the entire project period including a description and documentation of major project activities; evaluation of the project results and environmental benefits:

- monitoring data files and Data Summary;
- Technical Report characterizing trends and variability in historical water quality monitoring data;
- Technical Report characterizing trends and variability in collected water quality monitoring data.
- Technical Report summarizing historical information review, field surveys, and user interviews; Technical Report shall at least include those contents described for a Comprehensive RUAA in the latest version of the TCEQ *Procedures for a Comprehensive RUAA and a Basic RUAA Survey.*

Reports to NETMWD Project Management

WMS Project Manager and QAO conduct quarterly management review reports to cover QA/QC activities, data completion, and status of project objectives.

D1 Data Review, Verification, and Validation

For the purposes of this document, data verification is a systematic process for evaluating performance and compliance of a set of data to ascertain its completeness, correctness, and consistency using the methods and criteria defined in the Ana-Lab QAM, SOPs, and this QAPP. Validation means those processes taken independently of the data-generation processes to evaluate the technical usability of the verified data with respect to the planned objectives or intention of the project. Additionally, validation provides a level of overall confidence in the reporting of the data based on the methods used.

All data obtained from field and laboratory measurements will be reviewed and verified for conformance to project requirements, and then validated against the DQOs which are listed in Section A7. Only those data which are supported by appropriate quality control data and meet the measurement performance specification defined for this project will be considered acceptable and used in the project.

The procedures for verification and validation of data are described in Section D2. The WMS Technical Coordinator is responsible for ensuring that field data are properly reviewed and verified for integrity. The Laboratory Supervisor is responsible for ensuring that laboratory data are scientifically valid, defensible, of acceptable precision and bias, and reviewed for integrity. The WMS Data Manager will be responsible for ensuring that all data are properly reviewed and verified, and submitted in the required format to the project database. The WMS QAO is responsible for validating a minimum of 10% of the data produced in each task. Finally, the WMS Project Manager, with the concurrence of the WMS QAO, is responsible for validating that all data to be reported meet the objectives of the project and are suitable for reporting to TCEQ.

D2 Verification and Validation Methods

All field and laboratory data will be reviewed, verified and validated to ensure they conform to project specifications and meet the conditions of end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staff are listed in the first two sections of Table D2, respectively. Potential errors are identified by examination of documentation and by manual *(or computer-assisted)* examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step as specified in Table D2 is performed by the WMS Data Manager and WMS QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of laboratory and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

Another element of the data validation process is consideration of any findings identified during the monitoring systems audit conducted by the TSSWCB QAO. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. After the data are reviewed and documented, the WMS Project Manager validates that the data meet the DQOs of the project and are suitable for reporting to TSSWCB.

If any requirements or specifications are not met, based on any part of the data review, the responsible party should document the nonconforming activities and submit the information to the WMS Data Manager with the data. This information is communicated to the TSSWCB by the NETMWD in the Data Summary.

Table D2.1: Data Review Tasks

Field Data Review	**Responsibility**
Field data reviewed for conformance with data collection, sample handling and COC, analytical and QC requirements	TC / QAO
Post-calibrations checked to ensure compliance with error limits	TC / QAO
Field data calculated, reduced, and transcribed correctly	TC / QAO
Laboratory Data Review	**Responsibility**
Laboratory data reviewed for conformance with data collection, sample handling and COC, analytical and QC requirements to include documentation, holding times, sample receipt, sample preparation, sample analysis, project and program QC results, and reporting	Laboratory Manager / QAO
Laboratory data calculated, reduced, and transcribed correctly	Laboratory Manager / QAO
LOQs consistent with requirements for AWRLs.	Laboratory Manager / QAO
Analytical data documentation evaluated for consistency, reasonableness and/or improper practices	Laboratory Manager / QAO
Analytical QC information evaluated to determine impact on individual analyses	Laboratory Manager / QAO
All laboratory samples analyzed for all parameters	Laboratory Manager / QAO
Data Set Review	**Responsibility**
The test report has all required information as described in Section A9 of the QAPP	DM / PM
Confirmation that field and laboratory data have been reviewed	DM / PM
Data set (to include field and laboratory data) evaluated for reasonableness and if corollary data agree	DM / PM
Outliers confirmed and documented	DM / PM
Field QC acceptable (e.g., field splits and trip, field and equipment blanks)	DM / PM
Sampling and analytical data gaps checked and documented	DM / PM
Verification and validation confirmed. Data meets conditions of end use and are reportable	DM / PM

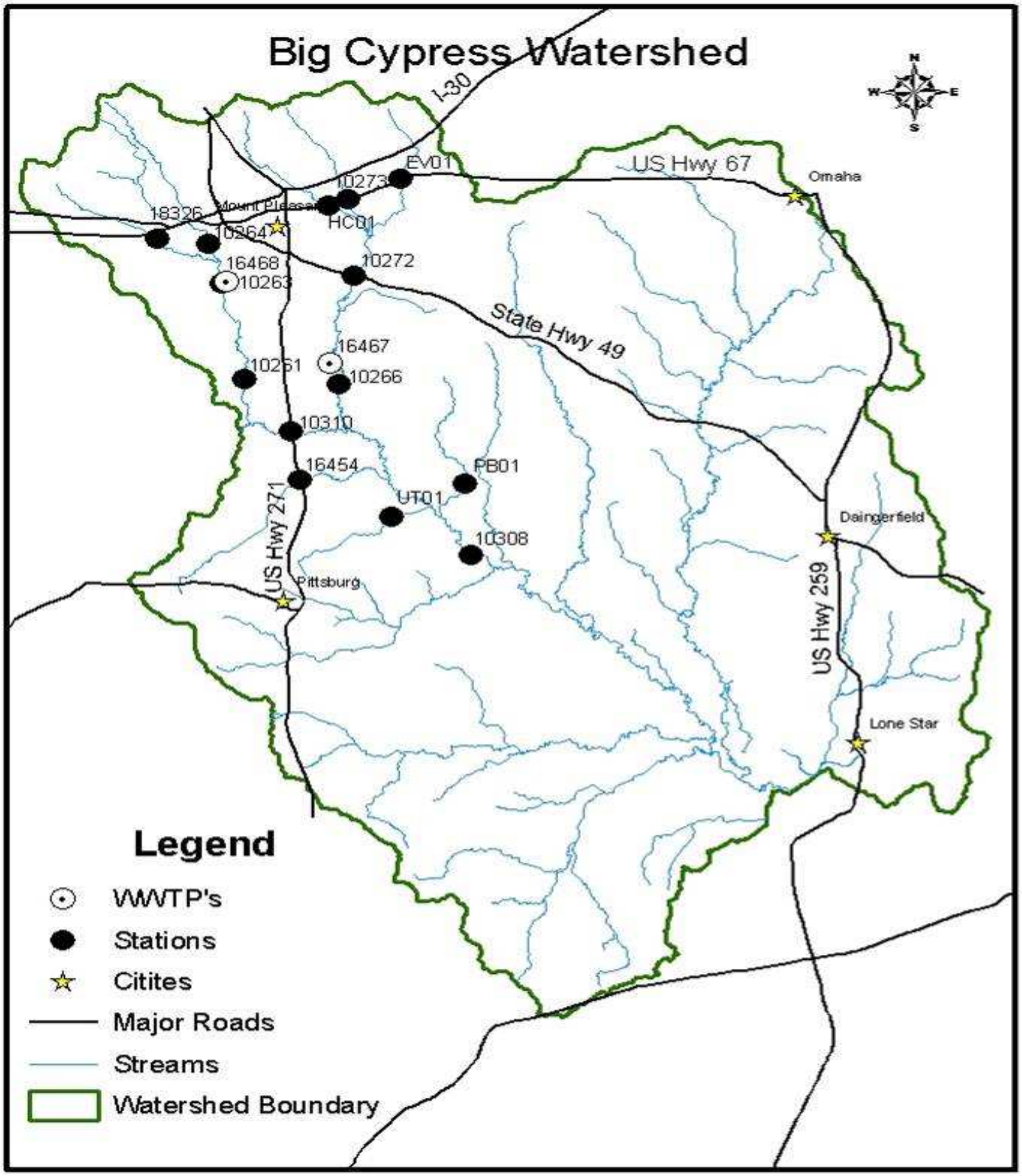
WMS Staff: DM – Data Manager; PM – Project Manager; QAO – Quality Assurance Officer; TC – Technical Coordinator

D3 Reconciliation with User Requirements

Data produced in this project, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used by TSSWCB and other project partners to assess sources of bacteria through data analysis and modeling and to ascertain the suitability of the streams for contact recreation use in order to facilitate local decision-making. Additionally, data meeting project requirements will be submitted by the TSSWCB to the TCEQ for use in the biennial CWA §305(b) assessment for the *Texas Water Quality Inventory and 303(d) List*. Data which do not meet requirements will not be submitted to SWQMIS nor will it be considered appropriate for any of the uses noted above.

The goal of the project is to remove the waterbodies in the study area from the 303(d) List; however, the mechanism is not predetermined. At the end of this two-year assessment project, possible outcomes include: 1) waterbodies are achieving current water quality standards, 2) waterbodies are achieving revised water quality standards, based on TCEQ triennial review process, 3) adequate data exists to support a RUAA to change water quality standards, 4) adequate data exists to develop a Watershed Protection Plan, or 5) adequate data exists to develop a TMDL and I-Plan for TCEQ adoption.

Appendix A. Area Location Map


Big Cypress Watershed
I-30
US Hwy 67
Omaha
EV01
10273
HC01
18326
Mount Pleasant
10264
16468
10263
10272
State Hwy 49
16467
10261
10266
10310
16454
PB01
UT01
10308
US Hwy 271
Pittsburg
Daingerfield
US Hwy 259
Lone Star
N
W
E
S
Legend
WWTP's
Stations
Citites
Major Roads
Streams
Watershed Boundary

Appendix B. Work Plan Excerpt

Task 5	Surface Water Quality Monitoring			
Objective	To provide sufficient water quality data to characterize bacteria loadings across the various flow regimes at a number of locations throughout the study area.			
Subtask 5.1	NETMWD will conduct routine ambient monitoring at 14 sites once every two weeks, collecting field, flow and bacteria parameter groups. The QAPP, as detailed in Task 3, will precisely identify sites. Six of these sites shall be the same as those in Subtask 5.4. The sampling period extends over 22 months. Total number of sample events scheduled for collection through this subtask is 642. Currently, routine ambient monitoring is conducted quarterly at 2 stations by TCEQ (10308 and 13631). NETMWD will avoid duplicative routine ambient monitoring at sites 10308 and 13631.			
	Start Date	Month 3	Completion Date	Month 24
Subtask 5.2	NETMWD will conduct routine effluent monitoring at 2 WWTFs once every two weeks, collecting field, flow and bacteria parameter groups. The QAPP, as detailed in Task 3, will precisely identify sites. The sampling period extends over 22 months. Total number of sample events scheduled for collection through this subtask is 94. Coordination between TPDES permittees and the TCEQ Regional Office will be required. Neither NETMWD nor TSSWCB shall submit WWTF data to TCEQ for use in permit compliance and enforcement; rather, WWTF data will only be used to estimate bacteria loadings from wastewater discharges and to assist TPDES permittees in improving management and operations.			
	Start Date	Month 3	Completion Date	Month 24
Subtask 5.3	NETMWD will conduct biased-flow monitoring under high flow (storm event influenced) conditions at the 14 stream sites (Subtask 5.1) and the 2 WWTFs (Subtask 5.2) during at least 8 storm events collecting field, flow and bacteria parameter groups (grab samples). The sampling period extends over 22 months. Total number of sample events budgeted for collection through this subtask is 128.			
	Start Date	Month 3	Completion Date	Month 24
Subtask 5.4	NETMWD will establish, and maintain, continuous flow monitoring gages at 6 sites (1 per tributary). These sites shall be located as close to the confluence with Big Cypress Creek as is feasible. Continuous sampling extends over 22 months.			
	Start Date	Month 3	Completion Date	Month 24
Subtask 5.5	NETMWD will transfer monitoring data from activities in Task 5 to TSSWCB for inclusion in the TCEQ SWQMIS at least quarterly. Data will be transferred in the correct format using the TCEQ file structure, along with a completed Data Summary, as described in the most recent version of *TCEQ Surface Water Quality Monitoring Data Management Reference Guide*. NETMWD will submit Station Location Requests as needed to obtain TCEQ station numbers for new monitoring sites. NETMWD will input monitoring regime, as detailed in the QAPP, into the TCEQ CMS. Data Correction Request Forms will be submitted to TSSWCB whenever errors are discovered in data already reported.			
	Start Date	Month 3	Completion Date	Month 24
Subtask 5.6	NETMWD will cooperate with BAEN, through TSSWCB project 09-55, to 1) conduct an LDC analysis of all historic and existing water quality monitoring data from the study area, and 2) refine those LDCs using water quality monitoring data collected through this project (Subtasks 5.1-5.4).			
	Start Date	Month 3	Completion Date	Month 21
Subtask 5.7	NETMWD will collaborate with SAML, through TSSWCB project 09-55, to conduct bacterial source tracking (BST) in the study area to assess and identify different sources contributing to bacteria loadings. Library-independent BST utilizing the *Bacteroidales* PCR genetic test will be combined with limited library-dependent BST utilizing the ERIC-PCR and RP combination method. NETMWD will collect duplicate water samples from a subset of those collected through Subtasks 5.1-5.3 and deliver those samples to SAML for BST. This BST subset shall be precisely described in the 09-55 QAPP. NETMWD will work with SAML to ensure sample collection activities employ adequate QA/QC mechanisms for BST as described in the 09-55 QAPP. The Texas Known Source Library may need to be supplemented with known fecal samples from the study area. If needed, NETMWD will collect known fecal samples as identified by SAML from sources such as livestock, wildlife, and domestic sewage and septage.			
	Start Date	Month 3	Completion Date	Month 21

Deliverables	• Station Location Request Forms (as needed) in electronic format • Monitoring data files and Data Summary in electronic format • Data Correction Request Forms (as needed) in electronic format • Technical Report characterizing trends and variability in historical water quality monitoring data • Technical Report characterizing trends and variability in collected water quality monitoring data

Tasks, Objectives and Schedules				
Task 6	Assess Attainability of Recreational Use			
Objective	To collect information that can be used to evaluate factors affecting attainment of recreational use in Big Cypress Creek and tributaries (Hart and Tankersley Creeks).			
Subtask 6.1	Utilizing information from Task 4 (comprehensive GIS inventory and current land use classification) and other relevant information, NETMWD will identify sites for RUAA data collection. Proposed sites should be located in areas where the waterbody is accessible to the public and has the highest potential for recreational use (primary contact). The sites should be well-spaced and, in general, distributed such that there are 3 sites for every 5 miles of stream. Sites shall be identified for the impaired reach of Big Cypress Creek and the entirety of Hart and Tankersley Creeks. Proposed sites shall at least include those from Subtask 5.1 (only those locations on Big Cypress, Hart, and Tankersley Creeks). The QAPP, as detailed in Task 3, will precisely identify selected sites. NETMWD will submit Station Location Requests as needed to obtain TCEQ station numbers for new monitoring sites.			
	Start Date	Month 3	Completion Date	Month 14
Subtask 6.2	NETMWD shall conduct a thorough historical information review of the recreational uses of the waterbody back to November 28, 1975. Historical resources that should be examined include, but are not limited to, photographic evidence, local newspapers, museum collections, published reports, historical society records, and long-term landowners/residents. Texas Parks and Wildlife Department and commercial providers of outdoor recreation goods and services should be consulted for historical information.			
	Start Date	Month 3	Completion Date	Month 14
Subtask 6.3	NETMWD will conduct 2 field surveys at each selected site (Subtask 6.1). Surveys shall be conducted during a normal warm season (air temperature $\geq$ 70°F) during baseflow conditions. Baseflow conditions are sustained or typical dry, warm-weather flows between rainfall events, excluding unusual antecedent conditions of drought or wet weather. The surveys should be performed during the period people would most likely be using the waterbody for contact recreation, typically March to October (e.g., spring break, summer, holidays, weekends). To ascertain the suitability of the streams for contact recreation use, field surveys shall document hydrological characteristics of the stream, such as width and depth of channel and substantial pools, flow/discharge, air/stream temperature, bank access, and stream substrate. Information to be collected shall at least satisfy those questions found on the Field Data Sheet from the latest version of the TCEQ staff draft *Recreational Use-Attainability Analyses (RUAAs) – Procedures for a Comprehensive RUAA and a Basic RUAA Survey*. NETMWD shall document and describe antecedent (prior to fieldwork) rainfall conditions (approximately 30 days) at each selected site.			
	Start Date	Month 3	Completion Date	Month 14
Subtask 6.4	NETMWD shall collect a digital photographic record of each selected site during the field surveys. Photographs shall include upstream, left and right bank, and downstream views. Any evidence of observed uses or indications of human use shall be photographed. Photographs should clearly depict the entire channel and each transect measured. To aid in documenting existing uses, NETMWD shall install, operate, and maintain motion-capture cameras at selected monitoring locations from Subtask 5.1 (only those locations on Big Cypress, Hart, and Tankersley Creeks).			
	Start Date	Month 3	Completion Date	Month 14

<table>
<tr><td>Subtask 6.5</td><td colspan="4">In order to obtain information on existing and historical uses and stream characteristics, NETMWD shall conduct interviews of 1) users present during the field surveys, 2) streamside landowners along the field survey transects, 3) local residents, and 4) commercial providers of outdoor recreation goods and services. Survey instrument shall include at least those questions found on the Interview Form from the latest version of the TCEQ staff draft Recreational Use-Attainability Analyses (RUAAs) – Procedures for a Comprehensive RUAA and a Basic RUAA Survey.
Start Date | Month 3 | Completion Date | Month 14</td></tr>
<tr><td>Deliverables</td><td colspan="4">• Station Location Request Forms (as needed) in electronic format
• Contact Information Form from the latest version of the TCEQ staff draft Recreational Use-Attainability Analyses (RUAAs) – Procedures for a Comprehensive RUAA and a Basic RUAA Survey
• Field Data Sheets and Data Summary in electronic format
• Digital photographic record, cataloged in an appropriate manner
• Interview Forms and Data Summary in electronic format
• Technical Report summarizing historical information review, field surveys, and user interviews; Technical Report shall at least include those contents described for a Comprehensive RUAA in the latest version of the TCEQ staff draft Recreational Use-Attainability Analyses (RUAAs) – Procedures for a Comprehensive RUAA and a Basic RUAA Survey</td></tr>
</table>

Appendix C. Data Summary and Checklist

Data Summary

Data Information

Data Source: **NETMWD**

Date Submitted: _____

Tag_ID Range: _____

Date Range: _____

Comments

Please explain in the space below any data discrepancies including:

- **Inconsistencies with AWRL specifications;**
- **Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TCEQ; and**
- **Other discrepancies.**

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

WMS Data Manager: _____

Date:

_____

DATA SUMMARY CHECKLIST

A completed checklist must accompany all data sets submitted to the TSSWCB by WMS.

Data Format and Structure

Y, N, or N/A

A. Are there any duplicate Tag_Ids in the Events file?
B. Are all StationIds associated with assigned station location numbers?
C. Are all dates in the correct format, MM/DD/YYYY?
D. Are all times based on the 24 hour clock format, HH:MM?
E. Is the Comment field filled in where appropriate (e.g. unusual occurrence, sampling problems)?
F. Are Source1, Source2 and Program codes used correctly?
G. Do the Enddates in the Results file match those in the Events file for each Tag_Id?
H. Are all measurements represented by a valid Storet code with the correct units?
I.. Are there any duplicate Storet codes for the same Tag_Id?
J. Are there any invalid symbols in the Greater Than/Less Than (Gt/lt) field?
K. Are there any tag numbers in the Result file that are not in the Event file?
L. Have verified outliers been identified with a "1" in the Remark field?

Data Quality Review

A. Are all the "less-than" values reported at or below the specified reporting limit?
B. Have checks on correctness of analysis or data reasonableness performed?
C. Have at least 10% of the data in the data set been reviewed against the field and laboratory data sheets?
D. Are all Storet codes in the data set listed in the QAPP?
E. Are all StationIds in the data set listed in the QAPP?

Documentation Review

A. Are blank results acceptable as specified in the QAPP?
B. Was documentation of any unusual occurrences that may affect water quality included in the Event table's Comments field?
C. Were there any failures in sampling methods and/or deviations from sample design requirements that resulted in unreportable data? If yes, explain on next page.
D. Were there any failures in field and laboratory measurement systems that were not resolvable and resulted in unreportable data? If yes, explain on next page.

Describe any data reporting inconsistencies with performance specifications. Explain failures in sampling methods and field and laboratory measurement systems that resulted in data that could not be reported to the TSSWCB. (attach another page if necessary):

Submitted by:
Date Submitted to TSSWCB:

TAG Series:

Date Range:

Data Source:

Comments (attach file if necessary):

Appendix D. Pressure Transducer Operation and Maintenance

4230 Flow Meter

Bubbler level sensing provides the most accurate measurement.

Isco 4230 Bubbler Flow Meters use an internal air compressor to force a metered amount of air through a bubble line submerged in the flow channel. By measuring the pressure needed to force air bubbles out of the line, the flow level is accurately determined.

Measurement accuracy of the 4230 is not affected by wind, steam, foam or turbulence, nor by suspended solids and rapidly changing head heights that can cause problems for some bubbler flow meters. Because only the bubble tube contacts the flow, corrosive chemicals are not a problem. The 4230 also resists damage by lightning and debris, making it ideal for stormwater applications.

Automatic Drift Compensation makes Isco bubbler flow meters the most accurate level measurement technology. In standby applications such as stormwater runoff monitoring, Automatic Drift Compensation also allows the 4230 to maintain calibration indefinitely. Automatic bubble line purging prevents clogging, and the meter's internal software senses rapidly rising heads and increases the bubble rate to maintain maximum accuracy.

Standard Features

- Built-in flow conversions for most applications, including Manning formula, data points, or equation for special situations.
- Two-line x 80-character backlit LCD.
- Choice of standard (10 ft) and extended (30 ft) level measurement range.
- Built-in dot matrix printer gives you an accurate, on-site printout
- Internal memory stores over 2 months of flow, rainfall, parameter, and sample data at 15 minute intervals.
- Automatic Drift Compensation eliminates effects of transducer drift and allows the 4230 to maintain level calibration indefinitely
- Interfacing for Sampler activation, connection to multiparameter water quality sonde, alarm outputs

Applications

- Portable and fixed-site flow measurement with weirs and flumes
- Pretreatment Compliance
- Stormwater Runoff Monitoring
- Permit Enforcement
- Sewer Flow Monitoring
- Combined Sewer Overflow Studies
- Wastewater Treatment Plant Operations
- Inflow and Infiltration Studies
- River and Stream Gauging

Options and Accessories

- Optional telephone modem - provides remote data retrieval, voice messaging, and dial-out alarm conditions
- Analog Outputs - up to 3 isolated internal 4-20 mA outputs
- Metering inserts for street level installation of bubble line in round pipes from 6 to 12 inches in diameter
- Non-resettable totalizer
- 674 Rain Gauge
- 581 RTD data retrieval device downloads up to 20 meters
- 270 DO module adds dissolved oxygen measurement/logging
- 201 pH module adds pH and temperature measurement/logging
- YSI 600 Multi-Parameter Water Quality Monitor
- Suspension equipment (to hang flowmeter in manhole)

Specifications

4230 Bubbler Flow Meter	
Size (H x W x D):	17.0 x 11.5 x 10.5 in. (43 x 29 x 26.7 cm) (without power source)
Weight:	17.3 lbs (7.8 kg) (without power source)
Material:	High-impact molded polystyrene structural foam

Enclosure:	NEMA 4X (IP65)
Power:	12 to 14V DC, 16 mA average at 12.5V DC
Typical Battery Life (printer set at 1 in./hr (2.5 cm/hr), 1 bubble per second, 15 minute purge, and continuous level reading interval)	
934 Nickel-Cadmium Battery:	7 to 10 days
946 Lead-Acid Battery:	10 to 15 days
948 Lead-Acid Battery:	2 to 3 months
Program Memory:	Non-volatile, programmable flash. Updateable without opening enclosure.
Display:	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)
Level-to-Flow Rate Conversions	
Weirs:	V-notch, rectangular with and without end contractions, Cipolletti
Flumes:	Parshall, Palmer-Bowlus, Leopold-Lagco,Trapezoidal, H, HS, HL
Manning Formula:	Round, U-channel, rectangular, trapezoidal Data Points Four sets of 50 level-flow rate points Equation Two-term polynomial
Totalizers	
LCD:	9-digit, floating decimal point, resettable
Mechanical (optional):	7-digit, non-resettable
Inputs and outputs	
Rain gauge input:	Contact closure, normally open. Resolution 0.01 or 0.004 in (0.25 or 0.1 mm)
Parameter Inputs:	pH, dissolved oxygen, conductivity, and temperature (with optional YSI 600 sonde); pH and temperature (with optional Isco 201 Parameter Module); or dissolved oxygen and temperature (with optional Isco 270 Parameter Module)
Sampler activation conditions:	Enabled, disabled, AND and OR combinations of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature
Sampler pacing output:	12V pulse
Sampler input:	Event mark, bottle number
Printer	
Recording modes:	Up to 3 graphs of level, flow rate, pH, DO, conductivity, and temperature vs time; includes totalized flow. Rainfall and sampler events (time and bottle number) are also recorded
Speed:	Off, 0.5, 1, 2, 4 in/hr (1.25, 2.5, 5, 10 cm/hr)
Recording Span:	User selectable with multiple over-ranges
Resolution:	1/240 of recording span
Reports Printed:	Flow meter program, 2 independent time interval reports, flow meter history, sampler history
Interval Report Contents:	Site number; time interval; total flow; minimum, maximum, and average flow rate, level, pH, DO, conductivity, and temperature, and time of occurrence; interval flow; total rainfall; number of samples, flow meter history and sampler history
Character Size (HxW):	0.09 x 0.07 in (2.4 x 1.7 mm)
Paper:	4.5 in. wide x 65 ft. (11.4 cm x 19.8 m), plain white paper, replaceable roll
Ribbon:	19.7 ft. (6.0 m) black nylon, replaceable
Data Storage Memory	
Capacity:	80,000 bytes (approx. 40,000 readings) divided into a maximum of 12 memory partitions. Equal to 100 days of level, rainfall, pH, DO, conductivity, and temperature readings at 15 minute intervals, plus 3,000 sample events. Optional expansion to 473,000 bytes (approx 236,500 readings)
Setup and Data Retrieval:	Windows-compatible computer with Isco Flowlink Software
Communication:	Direct connection, optional internal 2400 baud telephone modem with voice messaging, or optional internal short haul modem
Data Retrieval (optional):	Isco 581 Rapid Transfer Device (RTD)
Voice Messaging (with optional internal modem):	Calls up to 5 telephone numbers with programmable delay between calls, activated based on AND and OR combinations telephone of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature
Analog Outputs:	(optional) Up to 3 isolated internal outputs, 0 to 20 mA or 4 to 20 mA, scaleable based on level, flow rate, pH, DO, conductivity, or temperature, into a maximum of 750 ohms each
Relay Outputs:	2 form C relays with field selectable trip points based on flow rate (with optional High/Low Alarm Relays)
Serial Output:	Current status and readings, in response to command or automatically at selectable time intervals, ASCII comma separated values at 1200, 2400, 4800, or 9600 baud
Storage Temperature:	-40° to 140°F (-40° to 60°C)
Operating Temperature:	0° to 140°F (-18° to 60°C)

Bubbler	
Range:	0.1 to 10 ft (0.03 to 3.05 m)
Level Measurement Accuracy (Non-linearity, repeatability, and hysteresis at 25°C (77°F). Max error (±) for indicated level range.	
0.1 to 5.0 ft (0.03 to 1.52 m):	±0.005 ft (±0.002 m)
0.1 to 7.0 ft (0.03 to 2.13 m):	±0.01 ft (±0.003 m)
0.1 to 10 ft (0.03 to 3.05 m):	±0.035 ft (±0.011 m)
Temperature Coefficient (Maximum error (±) per degree of temperature change over compensated range)	
For level in feet:	±0.0003 x level x temperature change from 72°F
For level in meters:	±0.0009 x level x temperature change from 22°C
Automatic Drift Correction:	After a 5 minute warm-up period, zero level is corrected to ±0.002 ft. (±0.0006 m) at intervals between 2 and 15 minutes
Long-Term Level Calibration Change:	Typically 0.5% of reading per year
Ambient Operating Temperature Range:	0° to 140°F (-18° to 60°C)
Compensated Temperature Range:	32° to 140°F (0° to 60°C)

Teledyne Isco, Inc
4700 Superior Street, Lincoln NE 68504
Tel 402.464.0231 email: iscoinfo@teledyne.com

Appendix E. Acoustic Doppler Meter Operation

- **SonTek FlowTracker Instructions**
- **SonTek RiverCat Instructions**

SonTek Flow Tracker Steps

1. Vent the handheld controller.
2. Press the **Yellow** button to turn on unit.
3. Press **ENTER** for Main Menu.
4. From the Main Menu, press **3** to Start Data Run.
5. Press **1** to specify file name. This will be the LIMS#. Use the numbered keys for either number or letters. Press **ENTER**.
6. Press **9** to accept name.
7. Press **1** to enter Site name. This will be the station ID #. Use the numbered keys for either numbers or letters. Press **ENTER**.
8. Press **2** to specify operator. Use the numbered keys for either number or letters. Press **ENTER**.
9. Press **9** when ready to start data collection.
10. Press **ENTER**.
11. Press **1** to "Run Test" on the first measurement of the day. Press **2** to "Skip Test" on subsequent measurements.
12. Press **LEW/REW** to indicate right edge water or left edge water. This will be Station 0 and a depth of 0. The location may vary depending how the tag line is setup. If your tape is setup so that the waters edge is at zero then enter location as Zero. If the waters edge is at a different number then enter the measurement at the waters edge.
13. Press **Next Station**.
14. Press **Set Location**. Enter you distance away from the edge. Press **ENTER**.
15. Press **Set Depth**. Enter depth. Press **ENTER**.
16. If everything is correct, press **Measure**. If you make a mistake and need to change location or depth you can do so before you press Measure.
    NOTE: If you press measure and it gives you a QC Boundary Good, Fair, Poor question you can either reposition or move obstacles or just press whatever it says to just go ahead and take the measurement. (follow the screen instructions. Best and Good are good, I try to improve Fair and Poor).
17. After 40 seconds either a velocity measurement or QC warnings will be displayed. If you see a QC WARNING, determine if you need to repeat measurement, move obstacles, or adjust location. See common QC warnings. If you feel you need to repeat the measurement, press **2** and repeat measurement**.** If you are satisfied with the measurement press **1** to accept. The FlowTracker will automatically advance to the next Station.
18. Repeat Steps 13-16.
    NOTE: For each consecutive station the FlowTracker will default to the next location in the same increment as the station before. In most cases this will be correct and you will only need to change the depth for each station and press Measure. If you feel velocity or depth increases significantly, shorten you increments by using **Set Location**.
19. When you get to the last station you will almost always have to **Set Location** because it will be shorter than the other sections. Press **End Section**. Depth will be automatically set to 0.
20. Press **End Section** again. FlowTracker will then remind you of any QC errors, look for stations with > 10 % of the flow. Add a station before or after those stations. Press **End Section** when complete. Review GC errors again.
21. Press **1** to End Section.

22. Press **ENTER.**
23. This is the point of no return. Changes cannot be made to the measurement after this step. Press **Calculate Discharge.** Press **Calculate Discharge** again.
24. Press **0** to Exit.

Answers to Typical Questions:

1. Abort will only abort the one measurement you are taking. If you press it, you will be able to Accept or Repeat the measurement. If you want to chuck the whole thing, you have to at least get to the point where you can End Section and Calculate Discharge. You can begin again but will have to start over and come up with a new file name.
2. Delete will only delete things you enter, like file name when you are typing or location or depth.
3. If you do forget to enter depth or location, when the measurement is finished, just press 2 to repeat measurement and you can reenter set depth or location before you press measure.
4. You can redo a measurement at any time BEFORE you completely End Section. You just have to input the correct location. It may ask you a few questions to make sure you want to redo the location, but it can be done.

Common QC Warnings:

1. High Angle- As long as the sensor is perpendicular to the tape, you are fine.
2. High Spikes- Note your velocity reading. Check for obstacles and repeat. If you get the warning again see if velocities from first and second measurements are consistent. If they are accept reading. If not adjust probe and repeat.
3. SNR variation- Repeat once.

For the whole list see the manual software release notes Firmware 3.1 Software 2.10

SonTek RiverCat Quick Guide

1) Turn System ON:

Once the RiverCat has been assembled and the radio has been connected to the PC; turn on the RiverCat by pushing the Red Power Button. A series of red & green lights will flash on.

2) Open RiverSurveyor 4.60:

a) Double click the RiverSurveyor icon to open program.
b) Click on the "Systems" icon.
c) Choose the Comm port the "ADP" is connected.
d) Make sure Baud Rate is 9600.
e) Click "OK".

3) Connect to ADP:

a) Once the instrument is "Found", click on the "Go To ADP Setup" box.
b) A status bar should appear as the software communicates with the ADP.
c) Under Utilities on the right side: Click on Set System Time.
d) Adjust clock or Click on "Match to Computer Time".
e) Once the clock is adjusted, click on "Close".

4) Calibrate the Compass:

a) NOTE: Perform this operation outside and away from metal objects
b) Under Utilities on the right side: Click on "Calibrate Compass"
c) This will open a new box; choose "Start"
d) Slowly and gently rock the RiverCat side-to-side & front to back while rotating at least 720 degrees. Take at least 1 – 2 minutes for this process.
e) Once the rotation is complete, Select "Stop".
f) A report will appear on the quality of the calibration. Repeat the calibration if necessary. Otherwise, Click on "Close".

5) Create a File:

Under "Basic Settings" Tab:

a) Type in File name (up to 5 characters)
b) Adjust the averaging interval as required – refer to manual about averaging intervals.
c) Enter the "Magnetic Declination".
d) Enter the "Water Salinity".
e) Enter the Depth of Transducer head mounted below the water surface.

Under the "Profiling Range" Tab:

a) Enter the Maximum Depth of the water to be measured.
b) The "Number of Cells", "Cell Size", and "Blanking Distance" will automatically be calculated by the software. Manual adjustment is available.

Under the "Advanced Settings" Tab:

a) Select the type of coordinate system – default is "ENU".

b) Ensure that Bottom Track has "YES" selected.
c) Recorder should be "Disabled".
d) Temperature Mode – "Measured".
e) Click "OK"
f) "Transferring Files" Status bar should appear.
g) Both "ADP" and "Btrack" on the bottom right side of the screen should be Green.

6) Collect Data

a) Near the top left side of the screen, click on the Green Triangle (Play Button).
b) A status bar with "Interfacing with the ADP" and then "Verifying Settings" will appear.
c) Click on the Red Circle (Record Button) to begin recording data
d) Select "Left or Right Bank"
e) Enter the Measured Distance from the edge of water.
f) Select Bank Type – Sloped or Vertical.
g) After a pass has been completed, Click on the Red Circle again.
h) Enter the Ending Distance to the edge of water.
i) To make another pass, repeat steps 6c through 6h.
j) Once all of the measurements have been completed, Select the Black Box (Stop Button).
k) The system will disconnect from the PC.

NOTES:

1) To change units (English to Metric); Select File and then Configuration.
2) To view collected data, Select File and then Discharge Summary.
3) For Best Results the boat speed should be slower or the same as the measured water speed (velocity). The Bs/Ws box will be black when the speeds are similar; Yellow when boat speed is 1X the velocity; Red when boat speed is 2X the velocity.

SonTek Technical Support: 858.546.8327

Appendix F. Field and Chain of Custody Forms

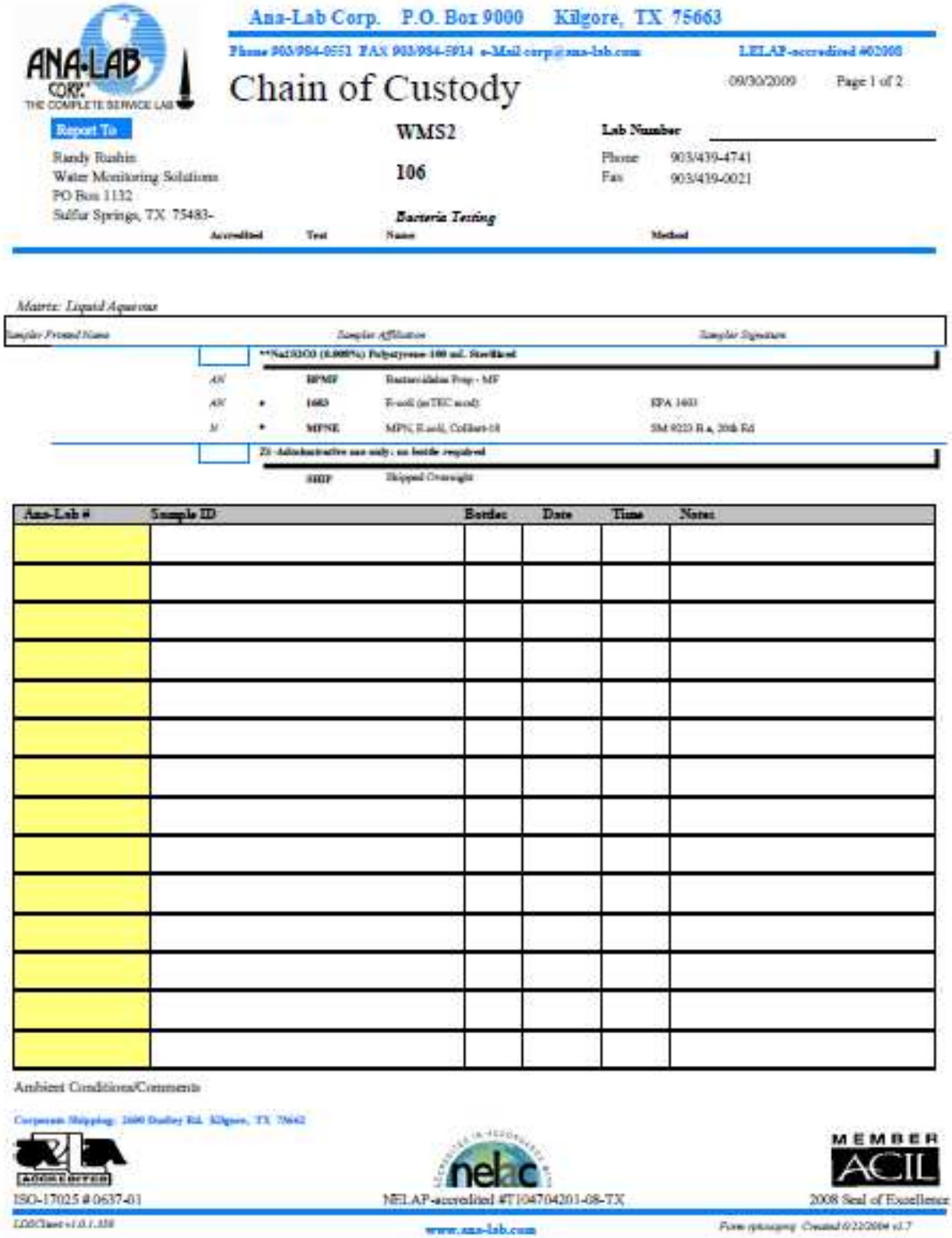
- **Big Cypress Creek Bacteria Assessment Field Form**
- ***E. coli* Chain of Custody Form**
- **BST Preparation Chain of Custody Form**
- ***Bacteroidales* Preparation Chain of Custody Form**
- **RUAA Contact Information Form**
- **Field Data Sheets – RUAA Survey**
- **Comprehensive RUAA Interview Form**
- **RUAA Summary**
- **Field and Laboratory Nonconformance Report**
- **Field and Laboratory Deficiency Worksheet**

Water Monitoring Solutions

Big Cypress Creek Bacteria Assessment
Field Form

Station ID:				**Date:**				**Time:**	
Station Location:									
Sample(s) Collected By:									
Days Since Last Rain:		**Total Rainfall** - 7 Days Inclusive Prior to Sampling (Inches):							
Stream Conditions: (circle one)									
Stream Type:		**Present Weather:**		**Aesthetics:**		**Wind Direction**		**Wind Intensity**	
perennial intermittent w/ perennial pools intermittent		Clear Partly Cloudy Cloudy Rain		Wilderness Natural Common Offensive		N S E W	NE SE NW SW	Calm Slight Moderate Strong	
Stage (ft.):		**Flow Severity:**		**Water Odor:**		**Water Color:**		**Water Clarity:**	
		No Flow Low Flow Normal	Flood High Dry	None Musky Fishy	Sewage Other:	Clear Green Brown	Yellow Olive Rust	Poor Fair	Good Excellent
Flow: **CFS** **MGD**									
Photos Taken	**Sample Depth (m)**	**Air Temp ºC**	**Water Temp ºC**	**Sp. Cond µS/cm**	**DO % sat**	**DO mg/L**	**DO chg**	**pH (s.u.)**	
Yes / No									
Parameters sampled:		**Field**		***E. coli***	**BST**	***Bacteroidales***			
Evidence of Flow Fluctuations:									
Observed Stream Uses:									
Adjacent Land Use:									
Channel Obstructions/Modifications:									
Visual Observations: (stream flow [if any], debris in water, canopy coverage, obvious signs of eutrophication, etc.):									
_									

Chain of Custody Form



Ana-Lab Corp. P.O. Box 9000 Kilgore, TX 75663

Phone 903/984-0551 FAX 903/984-5914 e-Mail corp@ana-lab.com LELAP-accredited #02000

Chain of Custody

09/30/2009 Page 1 of 2

Report To

Randy Rushin
Water Monitoring Solutions
PO Box 1132
Sulfur Springs, TX 75483-

WMS2

106

Lab Number

Phone 903/439-4741
Fax 903/439-0021

Bacteria Testing

Accredited	Test	Name	Method
		**Na2SO3 (0.009%) Polystyrene 100 mL Sterilized	
AN		BPMF	Bacteriological Prep - MF
AN	*	1603	E-coli (w/TEC med)	EPA 1603
M	*	MFNE	MPN, E.coli, Coliert-18	SM 9223 B a, 20th Ed
		Zi -Adischnitrative use only - no bottle required	
		SHIP	Shipped Overnight

Matrix: Liquid Aqueous

Sampler Printed Name *Sampler Affiliation* *Sampler Signature*

Ana-Lab #	Sample ID	Bottles	Date	Time	Notes

Ambient Conditions/Comments

Corporate Shipping: 2600 Dudley Rd. Kilgore, TX 75662

ISO-17025 # 0637-01

NELAP-accredited #T104704201-08-TX

2008 Seal of Excellence

LQSClient v1.0.1.350

www.ana-lab.com

Form sysscopy Created 6/22/2004 v1.7

Chain of Custody Form (cont.)

Ana-Lab Corp. P.O. Box 9000 Kilgore, TX 75663
Phone 903/984-0551 FAX 903/984-5914 e-Mail corp@ana-lab.com LELAP-accredited #02000

Chain of Custody

09/30/2009 Page 2 of 2

Report To

Randy Rushin
Water Monitoring Solutions
PO Box 1132
Sulfur Springs, TX 75483-

WMS2

106

Lab Number

Phone 903/439-4741
Fax 903/439-0021

Bacteria Testing

Accredited	Test	Name	Method

Date	Time	Relinquished		Received	
		Printed Name	Affiliation	Printed Name	Affiliation
		Signature		Signature	
		Printed Name	Affiliation	Printed Name	Affiliation
		Signature		Signature	
		Printed Name	Affiliation	Printed Name	Affiliation
		Signature		Signature	
		Printed Name	Affiliation	Printed Name	Affiliation
		Signature		Signature	

Sample Recieved on Ice? Yes No Method of Shipment: UPS Bus FedEx Lone Star Hand Delivered Other
Cooler/Sample Secure? Yes No Tracking/Shipping #

The accredited column designates accreditation by A - ACLA, N - NELAC, or x - not covered under ACLA or NELAC scope of accreditation.

Comments:

Contact Information Form

(This form should be completed prior to conducting a Basic RUAA Survey and/or Comprehensive RUAA. *The TCEQ Water Quality Standards Group will not consider or review a RUAA unless the appropriate entities listed below have been notified prior to the beginning of a RUAA. A RUAA should not be conducted until you have received a Notice to Proceed from the TCEQ Water Quality Standards Group.)*

River or stream name: _____

Ask the contacts if a recreational use-attainability analysis is appropriate for the river or stream and check Yes or No below. Document the name of the person contacted and the date they were notified about the proposed RUAA project.

Required Local Contacts:

Clean Rivers Partners (River Authority and other local partners)	Yes No	Date Notified: _____ Name: _____
Texas Parks and Wildlife Department region staff	Yes No	Date Notified: _____ Name: _____
TCEQ region staff	Yes No	Date Notified: _____ Name: _____
Texas State Soil Water Conservation Board	Yes No	Date Notified: _____ Name: _____

Suggested Additional Local Contacts (*Ask the contacts if a recreational use-attainability analysis is appropriate for the river or stream and check Yes or No below. If contacted, include information regarding notification date and person contacted on a separate page and attach it to this form*):

Local Parks and Recreation Departments	Yes	No
Local Government/Jurisdiction	Yes	No
Local Recreation Groups	Yes	No
Conservation Groups	Yes	No
Local County Extension Agent	Yes	No
Watershed Groups	Yes	No
Long-term Landowners/Adjacent Landowners	Yes	No
Texas Stream Team	Yes	No
Canoe Clubs	Yes	No
City Commissioners Office	Yes	No
Real estate agents	Yes	No
Local non-profits	Yes	No
City/county offices (Engineer, Health, Law Enforcement)	Yes	No
Flood control districts	Yes	No
Councils of Government	Yes	No
TPWD Game Warden	Yes	No
Other:_____	Yes	No

Contact Information Form

(This form must be completed prior to conducting a Basic RUAA Survey and/or Comprehensive RUAA.)

The TCEQ Water Quality Standards Group will not consider or review a RUAA unless the appropriate entities listed below have been notified prior to the beginning of a RUAA. A RUAA should not be conducted until you have received a Notice to Proceed from the TCEQ Water Quality Standards Group.

River or stream name: _____

Required Local Contacts:

Ask the contacts if a recreational use-attainability analysis is appropriate for the river or stream and check Yes or No below. Document the name of the person contacted and the date they were notified about the proposed RUAA project.

Clean Rivers Program Partner (River Authority and other local partners)	☐ Yes ☐ No	Date Notified: _____ Name: _____
Texas Parks and Wildlife Department region staff	☐ Yes ☐ No	Date Notified: _____ Name: _____
TCEQ region staff	☐ Yes ☐ No	Date Notified: _____ Name: _____
Texas State Soil and Water Conservation Board Statewide Resource Management Group srm-team@tsswcb.state.tx.us	☐ Yes ☐ No	Date Notified: _____ Name: _____

Suggested Additional Local Contacts:

If contacted, ask the contacts if a recreational use-attainability analysis is appropriate for the river or stream and check Yes or No below If contacted, include information regarding notification date and person contacted on a separate page and attach it to this form.

Local Parks and Recreation Departments	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Municipal Government/Jurisdiction	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
County Government/Jurisdiction	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Local Recreation Groups	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Conservation Groups	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Local Soil and Water Conservation Districts	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Texas AgriLife Extension Service (local County Extension Agent)	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
USDA Natural Resources Conservation Service (local field staff)	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Watershed Groups	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Long-term Landowners/Adjacent Landowners	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Texas Stream Team (formerly Texas Watch)	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Canoe Clubs	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
City Commissioners Office	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Real estate agents	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Local non-profits	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
City/county offices (Engineer, Health, Law Enforcement)	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area
Flood control districts	☐ Yes	☐ No	☐ Entity Not Contacted	☐ Entity Not in Project Area

Councils of Governments	□ Yes	□ No	□ Entity Not Contacted	□ Entity Not in Project Area
Texas Parks and Wildlife Department Game Warden	□ Yes	□ No	□ Entity Not Contacted	□ Entity Not in Project Area
Other:_____	□ Yes	□ No	□ Entity Not Contacted	□ Entity Not in Project Area

Draft Definitions (2010 TSWQS Revision)

- Primary contact recreation: Water recreation activities, such as wading by children, swimming, water skiing, diving, tubing, surfing, and whitewater kayaking, canoeing, and rafting, involving a significant risk of ingestion of water.
- Secondary contact recreation 1: Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion and that commonly occur.
- Secondary contact recreation 2: Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion but that occur less frequently than for secondary contact recreation 1 due to (1) physical characteristics of the waterbody and/or (2) limited public access.
- Noncontact recreation: Activities, such as ship and barge traffic, birding, and using hike and bike trails near a waterbody, not involving a significant risk of water ingestion, and where primary and secondary contact recreation should not occur because of unsafe conditions.

Information from Local Contacts:

1. If any entity answered no, please list the reason(s) why:

   _____
   _____
   _____

2. Did the local entities confirm that primary contact recreation activities frequently occur? □ Yes □ No
   Please describe how often the activities occur? □ Unknown □ Never □ Daily □ Monthly □ Yearly
   If no, explain: _____
   _____

3. Did the local entities confirm that secondary contact recreation 1 activities frequently occur? □ Yes □ No
   Please describe how often the activities occur? □ Unknown □ Never □ Daily □ Monthly □ Yearly
   If no, explain: _____
   _____

4. Did the local entities confirm that secondary contact recreation 2 activities frequently occur? □ Yes □ No
   Please describe how often the activities occur? □ Unknown □ Never □ Daily □ Monthly □ Yearly
   If no, explain: _____
   _____

5. Did the local entities confirm that noncontact recreation activities frequently occur? □ Yes □ No
   Please describe how often the activities occur? □ Unknown □ Never □ Daily □ Monthly □ Yearly
   If no, explain: _____
   _____

6. Do the local entities know if this waterbody provides substantial flow to a waterbody with primary contact recreation activities (e.g., swimming in a state/local park) or a bathing beach that is located immediately downstream? □ Yes □ No □ Unknown

   If yes, have the local entities provide the name of the waterbody and a description of the location of the primary contact recreation uses or bathing beach.

   _____
   _____

Notify TCEQ Water Quality Standards Group (required):

Send an e-mail notification to the TCEQ Water Quality Standards Group at standards@tceq.state.tx.us.

Notified: □ Yes □ No
Date Notified by e-mail: _____
Date TCEQ WQS e-mail Response Received: _____
WQS Group Contact Person Providing Response: _____
Did the WQS Group provide a Notice to Proceed with the RUAA? □ Yes □ No

Additional Local Contacts Made:

Name: _____
Entity: _____
Date Notified: _____

Name: _____
Entity: _____
Date Notified: _____

Name: _____
Entity: _____
Date Notified: _____

Name: _____
Entity: _____
Date Notified: _____

Name: _____
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Entity: _____
Date Notified: _____

Name: _____
Entity: _____
Date Notified: _____

Name: _____
Entity: _____
Date Notified: _____

Field Data Sheets – Basic RUAA Survey

(should be completed for each site)

Data Collectors & Contact Information:	
Date & Time:	County Name:
Stream Name:	
Segment No. or nearest downstream Segment No.:	
Description of Site:	

At any point during the Basic RUAA Survey it becomes apparent that primary contact recreation is clearly the use for the water body the investigator should stop conducting the UAA.

A. Stream Characteristics:

1. Check the following channel flow status that applies.
☐ dry ☐ no flow ☐ low ☐ normal ☐ high ☐ flooded

2. Check the following stream type that applies on the day of the survey:
☐ Ephemeral: A stream which flows only during or immediately after a rainfall event, and contains no refuge pools capable of sustaining a viable community of aquatic organisms.
☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a 7Q2 flow of less than 0.1 cubic feet per second is considered intermittent.
☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second.
☐ Perennial: A stream which flows continuously throughout the year. Perennial streams have a 7Q2 equal to or greater than 0.1 cubic feet per second.
☐ Designated or unclassified tidal stream: A stream that is tidally influenced. If you checked this box, you will need to contact the Water Quality Standards Group and evaluate whether or not a bathing beach is located along the tidal stream and whether or not a bathing beach is located along the estuary, bay or Gulf water that the tidal stream flows into.

3. Streamflow
Use USGS gage data (if a gage is located at a site or within a quarter mile of a site) or use the Stream Flow (Discharge) Measurement Form and follow the procedures outlined in the most recent TCEQ Surface Water Quality Monitoring Procedures, Volume 1, RG-415. If USGS gage data is used for a site, include that information as an attachment and list the streamflow on the sampling date below. If the stream flow taken at one site is representative of the flow at another site(s), then that flow can be used as the observed flow and should be documented below. If the stream flow measured at one site is different from another site, then stream flow should be taken at both sites. _____ cfs

4. Water Quality Data (Field Parameters)
Field parameters should be collected in accordance with the procedures outlined in the most recent TCEQ Surface Water Quality Monitoring Procedures, Volume 1.
Air Temp _____° C Water Temp _____° C

5. Riparian Zone (Mark dominant categories with L (Left Bank) and R (Right Bank). Bank orientation is determined by the investigator facing downstream.)

_____ Forest	_____ Urban	_____ Rip rap
_____ Shrub dominated corridor	_____ Pasture	_____ Concrete
_____ Herbaceous marsh	_____ Row crops	Other (specify): _____
_____ Mowed/maintained corridor	_____ Denuded/Eroded bank	

6. Ease of bank access to the water body: ☐ Easy ☐ Moderately easy ☐ Moderately difficult ☐ Difficult

7. Please describe access opportunities or explain why the site is not easily accessible (Attach photos for documentation):
_____
_____

8. Dominant Primary Substrate
☐Cobble ☐Sand ☐Silt ☐Mud/Clay ☐Gravel ☐Bedrock ☐Rip rap ☐ Concrete

Stream Name_____ Site: _____
Date: _____ Time: _____

B. Primary Contact Water Recreation Evaluation:
- Primary contact recreation draft definition: Water recreation activities, such as wading by children, swimming, water skiing, diving, tubing, surfing, and whitewater kayaking, canoeing, and rafting, involving a significant risk of ingestion of water.

1. Were water recreation activities that involve a significant risk of ingestion (full body immersion) observed at this site?
☐ Yes ☐ No primary contact recreation activities were observed
a. Check the following boxes of primary contact recreation activities observed at the time of the sampling event at the site (Attach photos of the activities or lack of activities).

☐ Wading-Children	☐ Tubing	☐ No primary contact activities that
☐ Wading-Adults	☐ Surfing	commonly occur were observed
☐ Swimming	☐ Whitewater-kayaking, canoeing, rafting	
☐ Water skiing	☐ Other: _____	
☐ Diving	☐ frequent public swimming-created by publicly owned land or commercial operations	

b. Check the number of individuals observed at the site: ☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.
☐ Water in mouth or nose of the individual ☐ Primary touch: Individual's body (or portion) immersed in water
☐ Secondary touch: fishing, pets and related contact with water ☐ Individual is in a boat touching water
☐ Individual is on shore near water within 8 meters (25ft) of water ☐ Individual is well away from water between 8 and 30 meters (100 ft) ☐ Not applicable

2. If primary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of primary contact (depth, etc.) (Attach photos, etc. for documentation).
_____
_____

3. Describe if there is public access (e.g. parks, roads, etc.) (Attach photos, maps, etc. for documentation).
_____
_____

4. Is an area with primary contact recreation activities or a bathing beach (e.g. state/local parks with swimming, etc.) located near (e.g. within 5 miles upstream and downstream) this site?

C. Secondary Contact Water Recreation Evaluation:
- Secondary contact recreation 1: Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion and that commonly occur.
- Secondary contact recreation 2: Water recreation activities, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity, not involving a significant risk of water ingestion but that occur less frequently than for secondary contact recreation 1 due to (1) physical characteristics of the water body and/or (2) limited public access.

1. Were water recreation activities observed at the site, but the nature of the recreation does not involve a significant risk of ingestion (e.g. secondary contact recreation activities)? ☐ Yes ☐ No secondary contact recreation activities were observed
a. Check the following boxes of secondary contact recreation activities that were observed at the time of the sampling event at the site (Attach photos of activities or lack of activities).
☐ Fishing
☐ Boating-commercial, recreational
☐ Non-whitewater-kayaking, rafting, canoeing
☐ No secondary contact recreation activities were observed
☐ Other secondary contact activities: _____

Date: _____ Time: _____

b. Check the number of individuals observed at the site.
☐ None ☐ 1-10 ☐ 11-20 ☐ 20-50 ☐ greater than 50

c. Check the following that apply regarding the individuals proximity to the water body.
☐ Secondary touch: fishing, pets and related contact with water ☐ In a boat touching water
☐ Body on shore near water within 8 meters (25ft) of water ☐ Body well away from water between 8 and 30 meters (100 ft)

2. If secondary contact recreation activities are not observed, describe the physical characteristics of the water body that may hinder the frequency of secondary contact (Attach photos, etc. for documentation).
_____
_____

3. If secondary contact recreation activities are observed, how often do water recreational activities occur that do not involve a significant risk of water ingestion? ☐ frequently ☐ infrequently
Please describe how often the activities occur? ☐ Unknown ☐ Never ☐ Daily ☐ Monthly ☐ Yearly

4. If infrequently, what is the reason? ☐ physical characteristics of the water body ☐ limited public access ☐ other
If other, list reasons: _____

5. Describe the physical characteristics of the water body that hinders the frequency of secondary contact recreation (depth, etc.) (Attach photos or depth measurements, etc. for documentation).
_____
_____
_____

6. Describe why there is limited public access (e.g. lack of roads, river or stream banks overgrown, etc.) (Attach photos, maps, etc. for documentation).
_____
_____
_____

D. Noncontact Recreation Evaluation
Noncontact recreation applies to water bodies where recreation activities do not involve a significant risk of water ingestion, and where primary and secondary contact recreation uses do not occur because of unsafe conditions, such as barge traffic.

1. Provide site-specific information and documentation (including photographs) regarding unsafe conditions, recreation activities, and presence or absence of water recreation activities.
_____
_____
_____
_____
_____
_____

E. Stream Channel and Substantial Pools Measurements
Please check the following which best describes the river or stream: ☐ Wadeable ☐ Non-wadeable

1. Wadeable Streams
Determine whether or not the average depth at the thalweg is greater than 0.5 meters and if there are substantial pools with a depth of 1 meter or greater. Walk an approximately 300 meter reach (total) at the site and take the following measurements within the 300 meter reach. Measurements should be taken during base flow conditions (sustained or typical dry, warm-weather flows between rainfall events, excluding unusual antecedent conditions of drought or wet weather

Also, take photos facing upstream, downstream, left bank, and right bank at the 30 meters, 150 meters, and 300 meters.
Photos #s (30 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

a) Substantial pools - Measure the length of each pool (if > 10 pools only measure 10 pools), the width (at the widest point), and the deepest depth. A substantial pool is considered a pool greater than 10 meters in length for the purposes of a Basic RUAA Survey. If depth and/or width measurements were not attainable, explain why.

	Length (meters)	**Width (meters)**	**Depth (meters)**
Pool 1			
Pool 2			
Pool 3			
Pool 4			
Pool 5			
Pool 6			
Pool 7			
Pool 8			
Pool 9			
Pool 10			

b)Average depth at the thalweg –Take depth measurements approximately every 30 meters to calculate an average depth at the thalweg (at least 10 measurements needed). If depth and/or width measurements were not attainable, explain why.

Distance	**Depth (meters)**
30 meters	
60 meters	
90 meters	
120 meters	
150 meters	
180 meters	
210 meters	
240 meters	
270 meters	
300 meters	
Average	

Field Data Sheets – Basic RUAA Survey

Stream Name_____ Site: _____
Date: _____ Time: _____

c) Stream width - Measure (1) the width at one point which represents the typical average width of the 300 meter reach; (2) the width at the narrowest point of the stream within the 300 meter reach; and (3) the width at the widest point of the stream within the 300 meter reach.

Measurement Type	Width (meters)
Typical Average Width of 300 meter reach	
Width at narrowest point of the stream within 300 meter reach	
Width at the widest point of the stream within 300 meter reach	

d) Is there sufficient water within a 300 meter stream reach during base flow conditions to support primary contact recreation? ☐ Yes ☐ No
COMMENTS:

_____
_____

2. Non-wadeable Streams
If accessible, take 10 width measurements which represent typical widths of the 300 meter reach. If the water is too deep and not accessible record the estimated average width of the water body.

Also, take photos facing upstream, downstream, left bank, and right bank at .
Photos #s (30 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (150 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____
Photos #s (300 meters) Upstream____ Downstream____ Left Bank ____ Right Bank____

# Measurements	Width (meters)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Field Data Sheets – Basic RUAA Survey

Stream Name_____ Site: _____
Date: _____ Time: _____

F. Additional RUAA Information

1. Check the following activities observed over the site reach.

☐ Drinking or water in mouth	☐ Playing on shoreline
☐ Bathing	☐ Picnicking
☐ Walking	☐ Motorcycle/ATV
☐ Jogging/running	☐ Hunting/Trapping
☐ Bicycling	☐ Wildlife watching
☐ Standing	☐ None
☐ Sitting	☐ Other: _____
☐ Lying down/sleeping	

2. Are there permanent or long-term hydrologic modifications that are constructed and operated in a way that affects the recreational uses? ☐ Yes ☐ No (If yes, please provide supporting documentation and photos.)
Comments: _____

3. Check any channel obstructions that apply (Attach photos).

☐ Culverts	☐ Fences	☐ Log jams	☐ Rip rap	☐ Water control structure
☐ Barbed wire	☐ Dams	☐ Thick vegetation	☐ Low bridges	☐ None
☐ Utility pipe	☐ Other (specify):_____			

4. Check all surrounding conditions that promote recreational activities (Attach photos of evidence or unusual items of interest).

☐ Campgrounds	☐ Stairs/walkway	☐ Roads (paved/unpaved)	☐ Other:_____
☐ Playgrounds	☐ Boating access (ramps)	☐ Populated area	☐ None of the Above
☐ Rural area	☐ Beach	☐ Docks or rafts	
☐ Residential	☐ Bridge crossing	☐ Commercial outfitter	
☐ National forests	☐ Commercial boating	☐ Nearby school	
☐ Urban/suburban location	☐ Trails/paths (hiking/biking)	☐ Power Line Corridor	
☐ Golf Course	☐ Paved parking lot	☐ Parks (national/city/county/state)	
☐ Sports Field	☐ Unimproved parking lot	☐ Public Property	

Comments:_____

5. Check all surrounding conditions that impede recreational activities (Attach photos of evidence or unusual items of interest).

☐ Private Property	☐ Fence
☐ No trespass sign	☐ Barge/ship traffic
☐ Wildlife	☐ Industrial
☐ Steep slopes	☐ None of the Above
☐ No public access	☐ Other:_____
☐ No roads	

Comments:_____

6. Check any indications of human use (Attach photos).

☐ Roads	☐ RV/ATV Tracks	☐ NPDES Discharge	☐ Organized event
☐ Rope swings	☐ Camping Sites	☐ Gates on corridor	☐ No Human Presence
☐ Dock/platform	☐ Fire pit/ring	☐ Children's toys	
☐ Foot paths/prints	☐ Fishing Tackle	☐ Remnant's of Kid's play	
☐ Other: _____			

Comments:_____

Stream Name_____ Site: _____
Date: _____ Time: _____

7. Check all water characteristics that apply (Attach photos).
Aquatic Vegetation: ☐ absent ☐ rare ☐common ☐abundant
Algae Cover: ☐ absent ☐ rare ☐common ☐abundant
Odor: ☐ none ☐ rare ☐common ☐abundant
Color: ☐ clear ☐ green ☐red ☐ brown ☐ black
Bottom Deposit: ☐ sludge ☐ solids ☐ fine sediments ☐none ☐other
Water Surface: ☐ clear ☐ scum ☐ foam ☐ debris ☐ oil
Other:

_____
_____

8. Vertebrates Observed within 300 meter reach

Snakes	☐ None	☐ slight presence	☐ moderate presence	☐ large presence
Water Dependent Birds	☐ None	☐ slight presence	☐ moderate presence	☐ large presence
Alligators	☐ None	☐ slight presence	☐ moderate presence	☐ large presence

Comments: _____

9. Mammals Observed within 300 meter reach

Wild	☐ None	☐ slight presence	☐ moderate presence	☐ large presence
Domesticated Pets	☐ None	☐ slight presence	☐ moderate presence	☐ large presence
Livestock	☐ None	☐ slight presence	☐ moderate presence	☐ large presence
Feral Hogs	☐ None	☐ slight presence	☐ moderate presence	☐ large presence

Comments: _____

10. Evidence of wild animals or evidence of birds, cattle, hogs, etc.
☐ Tracks ☐ Fecal droppings ☐ Bird nests

11. Garbage Observed

Large garbage in the channel	☐ None	☐ Rare	☐ Common	☐ Abundant
Small garbage in the channel	☐ None	☐ Rare	☐ Common	☐ Abundant
Bank Garbage	☐ None	☐ Rare	☐ Common	☐ Abundant

Briefly describe the kinds of garbage observed: _____
_____
_____

12. Is the site located in a wildlife preserve with large wildlife (i.e waterfowl) population? ☐ Yes ☐ No

13. Please document any other relevant information regarding recreational activities and the water body in general (for example, area outside of the stream reach evaluated).
_____
_____
_____
_____
_____

Flow Discharge Measurement

Discharge measurement reports may be formatted differently, but must maintain and report the same information as above.

Field Data Sheet - Basic RUAA Survey

Stream Flow (Discharge) Measurement

Stream:______________________________ Date:______________

Site:______________________________ Site

Description:______________________________

Time Begin:__________ Time End:__________ Meter Type:______________________

Observers:______________________ Stream Width*:__________ Section Width (W):__________

Observations:______________________________

Section Midpoint (ft) (m)	Section Depth (ft) (m) (cm) (D)	Observational Depth** (ft)(m)	Velocity (V)		Flow (Q) (m^3/s) (ft^3/s) Q = (W)(D)(V)
			At Point (ft/s)(m/s)	Average (ft/s)(m/s)	

Comprehensive RUAA Interview Form

Stream Name: _____ Segment #: _____ Site: _____

Interviewer's Name: _____
Date & Time (include AM or PM): _____
Interviewed: ☐ In person ☐ By phone ☐ By mail

☐ No interviews were conducted
If no interviews were conducted, please provide an explanation:

_____
_____

*Are you willing to respond to a short survey about this stream? ☐ Yes ☐ No
If yes, complete contact information for the interviewee below. Do not collect name or contact information if interviewee is a minor. The contact information portion is not required if the interviewee does not want to provide this information.

Legal name: _____ Daytime phone number: _____
Mailing address: _____
Interviewee selected because (e.g., house adjacent to stream; standing by stream, etc.)

_____
_____

Questions:

1. Are you familiar with this stream? ☐ Yes ☐ No If yes, how many years? _____
   If yes, proceed to #2. If no, stop here and do not conduct an interview.

2. Describe the location(s) of the stream reach the interviewee is familiar with:

_____
_____

3. Have the interviewer characterize the stream flow. Since the interviewer may not be familiar with TCEQ's definitions or distinction between the different water bodies, please refer to the definitions listed below when asking this question.

☐ Ephemeral: A stream which flows only during or immediately after a rainfall event, and contains no refuge pools capable of sustaining a viable community of aquatic organisms.
☐ Intermittent: A stream which has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a 7Q2 flow of less than 0.1 cubic feet per second is considered intermittent. (Channel contains flowing water for only a portion of the year and surface water may be absent at times.)
☐ Intermittent w/ perennial pools: An intermittent stream which maintains persistent pools even when flow in the stream is less than 0.1 cubic feet per second. (When not flowing, the water may remain in isolated pools.)
☐ Perennial: A stream which flows continuously throughout the year. Perennial streams have 7Q2equal to or greater than 0.1 cubic feet per second.

4. Have you or your family personally used the stream for recreation? ☐ Yes ☐ No
   If yes, proceed to #6. If no, proceed to #5.

5(a). List reasons stream not used. _____
_____

5(b). Proceed to #7.

Stream Name: _____ Segment #: _____ Site: _____

6.) How do you use the stream? When did these uses occur (e.g. year(s); season) and how often (times/year)? What location did these uses occur (get specific location and mark on a map)?

☐ Swimming ☐ Skin Diving ☐ Water Skiing ☐ Wind surfing ☐ Hunting ☐ Wading-Adults
☐ Tubing ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Wading-Children

_____
_____

7. Have you observed others using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #8. If no, proceed to #9.

8. What kinds of uses have you witnessed? When did you witness these uses occurring (e.g. year(s); season) and how often (times/year)? What location did these uses occur (get specific location and mark on a map)?

☐ Swimming ☐ Skin Diving ☐ Water Skiing ☐ Wind surfing ☐ Hunting ☐ Wading-Adults
☐ Tubing ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Wading-Children

_____
_____

9. Have you heard about anyone using this stream for recreation? ☐ Yes ☐ No
If yes, proceed to #10. If no, conclude the interview.

10. What kind of uses have you heard about? When did you hear that these uses occur (e.g. year(s); season) and how often (times/year)? What location did these uses occur (get specific location and mark on a map)?

☐ Swimming ☐ Skin Diving ☐ Water Skiing ☐ Wind surfing ☐ Hunting ☐ Wading-Adults
☐ Tubing ☐ Kayaking ☐ Rafting ☐ Trapping ☐ SCUBA diving
☐ Snorkeling ☐ Fishing ☐ Boating ☐ Canoeing ☐ Wading-Children

_____
_____

11. Can you recommend someone else we could contact that knows the stream? ☐ Yes ☐ No
If yes, list person's contact information: _____

_____

12. Additional comments (from the interviewee or interviewer):

_____
_____

RUAA Summary
(Not part of the Field Data Sheet)

This form should be filled out after RUAA data collection is completed. Use the Contact Information Form, Field Data Sheets from all sites, Historical Information Review, and other relevant information to answer the following questions on the water body.

Name of water body: _____
Segment No. or Nearest Downstream Segment No.: _____
Classified?: _____
County: _____

1. Observations on Use
    a. Do primary contact recreation activities occur on the water body?
        ☐ frequently ☐ seldom ☐ not observed or reported ☐ unknown

    b. Do secondary contact recreation 1 activities occur on the water body?
        ☐ frequently ☐ seldom ☐ not observed or reported ☐ unknown

    c. Do secondary contact recreation 2 activities occur on the water body?
        ☐ frequently ☐ seldom ☐ not observed or reported ☐ unknown

    d. Do noncontact recreation activities occur on the water body?
        ☐ frequently ☐ seldom ☐ not observed or reported ☐ unknown

2. Physical Characteristics of Water Body
    a. What is the average thalweg depth? _____ meters

    b. Are there substantial pools deeper than 1 meter? ☐ yes ☐ no

    c. What is the general level of public access?
        ☐ easy ☐ moderate ☐ very limited

3. Hydrological Conditions (Based on Palmer Drought Severity Index)
☐ Mild-Extreme Drought ☐ Incipient dry spell ☐ Near Normal ☐ Incipient wet spell ☐ Mild-Extreme Wet

Field and Laboratory Nonconformance Report
Big Cypress Creek Bacteria Assessment

Date:	
Nonconformance/ Deficiency:	
Root Cause(s):	
Programmatic Impact(s):	
Corrective Action(s) to Address Nonconformance/ Deficiency:	
Person(s) Responsible for each Corrective Action:	
Follow-up Action to Prevent Recurrence:	
Timetable for Completion of Action(s):	
Means of Documentation of Completion of each Corrective Action(s):	

Reviewed by: _____ Field or Lab Supervisor _____ Date

Approved by: _____ Quality Assurance Officer _____ Date

Field and Laboratory Deficiency Worksheet
Big Cypress Creek Bacteria Assessment

Date:	
Deficiency:	
Person(s) Involved:	
Reason for Deficiency:	
Impact of Deficiency:	

Date:	
Follow-up Action:	
Quality Review:	

Reviewed by: _____ Field or Lab Supervisor _____ Date

Approved by: _____ Quality Assurance Officer _____ Date

Appendix G. RUAA Sample Sites

Proposed Stations on Big Cypress Creek

TCEQ ID	Station Name	Site Description	Latitude (N)	Longitude (E)
BCC1*	Big Cypress Creek below Lake Bob Sandlin Spillway	Big Cypress Creek 1.0 km immediately below the spillway at Lake Bob Sandlin	33.075042	-94.995213
10309	Big Cypress Creek above Tankersley Creek	Big Cypress Creek 100 m upstream of Tankersley Creek confluence, south of Mt. Pleasant	33.076157	-94.984631
10310	Big Cypress Creek at US 271	Big Cypress Creek at US 271, 6.9 km north of Pittsburg	33.072987	-94.965431
BCC2*	Big Cypress Creek at Hart Creek	Big Cypress Creek at the confluence with Hart Creek south of Mt. Pleasant	33.074390	-94.940690
BCC3*	Big Cypress Creek at Walkers Creek	Big Cypress Creek at the confluence with Walkers Creek confluence, south of Mt. Pleasant	33.052610	-94.921280
10308	Big Cypress Creek at SH 11	Big Cypress Creek bridge on SH 11 east of Pittsburg	33.019730	-94.883558
BCC4*	Big Cypress Creek at CR 2231	Big Cypress Creek at Sand Crossing approximately 2.2 km upstream of US 259	32.912700	-94.735410

*- Location without TCEQ Station ID number; GPS coordinates are approximate.

Proposed Stations on Tankersley Creek

TCEQ ID	Station Name	Site Description	Latitude (N)	Longitude (E)
Tank1*	Tankersley Creek at Unnamed Road Crossing	Tankersley Creek at Unnamed Rd above 1.1 km northwest of CR 1140	33.20812	-95.04005
15512	Tankersley Creek at FM 1734	Tankersley Creek at FM 1734, 880 M NNW of Tankersley Lake Headwaters, NW of Mount Pleasant	33.18858	-95.02696
15513	Tankersley Creek at US 67	Tankersley Creek at US 67 approximately 200 m downstream of I-30, west of Mt. Pleasant	33.16425	-95.01290
10264	Tankersley Creek at FM 899	Tankersley Creek at FM 899 west of Mt. Pleasant	33.15537	-95.00370
10263	Tankersley Creek at FM 127	Tankersley Creek at FM 127, 3 km SW of Mt. Pleasant	33.13837	-94.99770
10261	Tankersley Creek at FM 3417	Tankersley Creek at FM 3417 5.7 km south of Mt. Pleasant	33.09589	-94.98650

*- Location without TCEQ Station ID number; GPS coordinates are approximate.

Proposed Stations on Hart Creek

Map Legend	TCEQ ID	Station Name	Site Description	Latitude (N)	Longitude (E)
A	Hart01*	Hart Creek at CR 3210	Hart Creek at Titus CR 3210 approximately 0.9 km upstream of I-30.	33.19424	-94.9512
B	10273	Hart Creek at US 67	Hart Creek at US 67 NE of Mt. Pleasant	33.17605	-94.9421
C	Hart02*	Hart Creek at CR 4205	Hart Creek at CR 4205 east of Mt. Pleasant	33.15419	-94.9327
D	10272	Hart Creek at SH 49	Hart Creek at SH 49 SSE of Mt. Pleasant	33.14232	-94.9384
E	10271	Hart Creek at CR SE 28 (CR 4410)	Hart Creek at Titus CR SE 28 (Tennison Rd.) south of Mt. Pleasant, approximately 10.3 km upstream of confluence with Big Cypress Creek	33.12635	-94.945
F	10266	Hart Creek at CR SE 12 (CR 4550)	Hart Creek at Titus CR SE 12, 3.8 km upstream of confluence with Big Cypress Creek south of Mt. Pleasant	33.09419	-94.9444

*- Location without TCEQ Station ID number; GPS coordinates are approximate.